DEPARTMENT OF TRANSPORTATION

COAST GUARD

BULLETIN NO. 64

Report of the International Ice Patrol Service in the North Atlantic Ocean

SEASON OF 1978

CG-188-33

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

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Bulletin No. 64

REPORT OF THE INTERNATIONAL ICE PATROL SERVICES IN THE NORTH ATLANTIC OCEAN

Season of 1978

CG-188-33

FOREWORD

Forwarded herewith is Bulletin No. 64 of the International Ice Patrol describing the Patrol's services, and ice observations and conditions during the 1978 season.

JOHN C. FUECHSEL
Acting Chief, Office of Operations

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PREFACE

This is the 64th in a series of annual reports on the International Ice Patrol Service in the North Atlantic Ocean. It contains information on Ice Patrol organization, communications and operations, and on ice and environmental conditions and their relationship in 1978.

The authors of this report acknowledge applicable ice, weather and oceanographic data provided by the Canadian Department of the Environment, U.S. Weather Service, U.S. Naval Weather Service and the U.S. Coast Guard Oceanographic Unit. Recognition is given to the Marine Science Technicians and Yeomen of the Marine Science Branch of the Commander, U.S. Coast Guard Atlantic Area for their assistance in the preparation of this manuscript and illustrations for this report.

The U.S. National Aeronautical and Space Administration contribution to the continuing effort to devise an all weather method of detecting and identifying icebergs is gratefully acknowledged.

The continued cooperation and generosity by the Canadian Coast Guard Radio Station St. John's/VON is worthy of particular note and gratitude.

INTERNATIONAL ICE PATROL, 1978

The 1978 International Ice Patrol Service in the North Atlantic Ocean was conducted by the United States Coast Guard under the provisions of Title 46, United States Code, Sections 738, 738a through 738d, and the International Convention for the Safety of Life at Sea, 1960, Regulations 5 through 8. The International Ice Patrol is a service for observing and disseminating information on ice conditions in the Grand Banks Region of the Northwest Atlantic Ocean. During the ice season, the southeastern, southern and southwestern limits of the regions of icebergs in the vicinity of the Grand Banks of Newfoundland are guarded for the purpose of informing passing ships of the extent of this dangerous region. The International Ice Patrol also studies ice conditions in general with emphasis on the formation, drift and deterioration of icebergs, and assists ships and personnel requiring aid within the limits of operation of the Ice Patrol forces.

The International Ice Patrol is directed from the Ice Patrol Office located at the U.S. Coast Guard Support Center, Governors Island, New York. The office gathers ice and environmental data from a variety of sources, maintains an ice plot, forecasts ice conditions, prepares the twice daily Ice Bulletin, replies to requests for special ice information, and executes operational control of the Aerial Ice Reconnaissance Detachment, the Ice Patrol oceanographic cutter and the Surface Patrol cutter when assigned.

Vice Admiral William F. REA III, U.S. Coast Guard, was Commander, International Ice Patrol through 30 June 1978. Vice Admiral Robert I. Price, U.S. Coast Guard, was Commander, International Ice Patrol for the remainder of the season. Captain Thomas C. Volkle, U.S. Coast Guard, was directly responsible for the management of the patrol.

Preseason Ice Patrol flights were made in January and February, 1978. The Aerial Reconnaissance Detachment was deployed to St. John's, Newfoundland, on 20 March 1978. The detachment returned to the United States on 20 July 1978.

The 1978 Ice Season officially commenced at 0000 GMT, 21 March 1978, when the first Ice Bulletin was broadcast by International Ice Patrol Radio Station Boston/NIK, U.S. Navy LCMP Broadcast Radio Station Norfolk/NAM, Canadian Maritime Command Radio Station Mill Cove/CFH, and Canadian Coast Guard Radio Station St. John's/VON. Ice Patrol Radio Station Boston broadcasts an ice radio facsimile chart once a day.

The USCGC EVERGREEN, commanded by Commander Arthur B. SHEPARD, U.S. Coast Guard, conducted oceanographic cruises for the Ice Patrol from 31 March through 22 April, 1 June through 26 June and 11 August through 2 September, 1978.

During the 1978 season, an estimated 75 icebergs drifted south of 48°N. Table 1 shows estimated numbers of icebergs that drifted south of 48°N.

Table 1

ESTIMATED NUMBER OF ICEBERGS SOUTH OF LATITUDE 48N, SEASON 1978

	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	TOTAL
1978	0	0	0	0	0	0	5	28	35	7	0	0	75
TOTAL 1946 - 1978	10	2	4	11	64	265	1080	2979	2932	1758	483	100	9688
AVERAGE 1946 - 1978	0	0	0	0	2	8	33	90	89	53	15	3	294
TOTAL 1900 - 1978	256	109	110	91	184	716	3182	7824	10,015	5276	1679	489	29,931
AVERAGE 1900 - 1978	3	1	1	1	2	9	40	99	127	67	21	6	379

AERIAL ICE RECONNAISSANCE

During the period 1 September 1977 to 31 August 1978, a total of 94 ice observation flights were flown; 12 preseasonal and 82 seasonal. The objective of the preseason survey was to study the iceberg distribution patterns in the Labrador Sea and to evaluate the iceberg potential of the developing season. The season flight objectives were to locate the southwestern, southern and southeastern limits of icebergs, to evaluate the short-term iceberg potential of the waters immediately north of the Grand Banks, and occasionally to determine the iceberg distribution along the Labrador coast.

The flight statistics shown in Table 2 do not include flight time required to make the passages between U.S. Coast Guard Air Stations Elizabeth City, North Carolina and Clearwater, Florida and the Ice Patrol operating airfield at St. John's, Newfoundland for crew relief or aircraft maintenance.

Aerial ice reconnaissance was accomplished by U.S. Coast Guard HC-130B (Lockheed Hercules) four-engine aircraft from Coast Guard Air Stations at Elizabeth City, North Carolina and St. Petersburg, Florida. During the ice season, the aircraft operated out of Torbay Airport, St. John's, Newfoundland, Canada.

On 10 March the Ice Reconnaissance Detachment deployed to St. John's. The Detachment remained at St. John's through the season, returning to the United States on 20 July 1978.

Table 2—Aerial Ice Reconnaissance Statistics 1 September 1977 to 31 August 1978

	Number of flights	*A/C flight hrs*
Preseason	12	63
SLAR T&E	6	32.1
Regular season	76	341
Total	94	436.1

COMMUNICATIONS

Ice Patrol communications included ice reports, environmental conditions, Ice Bulletins, special ice advisories, a daily Facsimile Chart and the administrative and operational traffic necessary to conduct the Patrol. The Ice Bulletin was transmitted by teletype from the Ice Patrol office in New York twice each day to over 30 addressees, including those radio stations which broadcast the Bulletin. These stations were the U.S. Coast Guard Communications Station Boston/NIK/NMF, U.S. Naval Radio Station Thurso/GXH, U.S. Naval Radio Station Keflavik/NRK, Canadian Coast Guard Radio Station St. John's/VON and Canadian Maritime Command Radio Station Mill Cove/CFH.

International Ice Patrol Ice Bulletins were broadcast by Coast Guard Communications Station Boston/NMF/NIK by CW at 0018 GMT on 5320 and 8502 kHz and at 1218 GMT on 8502 and 12750 kHz. After a two minute series of test signals, the transmissions were made at twenty-five (25) words per minute and then repeated at sixteen (16) words per minute. Coast Guard Communications Station Boston/NIK/NMF also transmitted a daily radio facsimile broadcast depicting the locations of icebergs and sea ice at 1600 GMT simultaneously on 8502 and 12750 kHz at a drum speed of 120 revolutions per minute.

Ice Bulletins were also broadcast twice daily by U.S. Naval Radio Stations Norfolk/NAM, Thurso/GXT and Keflavik/NRK on the LCMP Broadcasts between 0500–0600 GMT and 1700–1800 GMT on a wide range of frequencies. Canadian Coast Guard Radio Station St. John's/VON made CW broadcasts at 0000 and 1330 GMT on 478 kHz, and Canadian Maritime Radio Station Mill Cove/CFH also broadcast at 0130 and 1330 GMT on a wide range of low to high frequencies.

Special broadcasts were made by Canadian Coast Guard Radio Station St. John's/VON as required when icebergs were sighted outside the limits of all known ice between regularly scheduled broadcasts. These transmissions were preceded by the International Safety Signal (TTT) on 500 kHz.

Sea ice information services for the Gulf of St. Lawrence, as well as the approaches, from 58–00W to 66–30W longitudes including the Strait of Belle Isle to west of Belle Isle itself, were provided by the Canadian Ministry of Transport during the period from December to approximately late June. Ships obtained ice information by contacting the Ice Operations Officer, Dartmouth, Nova Scotia via any east coast Canadian Coast Guard Radio Station.

Supplementary ice conditions and navigational warnings for the Strait of Belle Isle, the coast of Newfoundland and the Grand Banks were obtained by contacting Canadian Coast Guard Radio Stations: St. Anthony/VCM, Comfort Cove/VOO, St. John's/VON and St. Lawrence/VCP.

Communications statistics for the period 1 September 1977 through 31 August 1978 are shown in Table 3.

Table 3—Communications Statistics

Number of ice reports received from ships	399
Number of ships furnishing ice reports	84
Number of ice reports received from commercial aircraft	10
Number of sea surface temperature reports	478
Number of ships furnishing sea surface temperature reports	44
Number of ships requesting special ice information	19
Number of NIK ice bulletins issued	249
Number of NIK facsimile broadcasts	124

Of the number of ships furnishing Ice Patrol with ice reports and special sea surface temperature observations, the eight most outstanding contributors for the period 1 September 1977 to 31 August 1978 were:

M/BAKKAFOSS/TFXQ	108
CSS HUDSON/CGDG	30
M/V ATLANTIC SAGA/SLNA	28
USNS MIRFAK/NZAE	16
M/V ARTADI/5MAN	13
M/V FINNFOREST/OGIL	12
M/V SANDGATE/GVZG	11
M/V MELTEMIZ/SYCH	10

ICE CONDITIONS, 1978 SEASON

September-December 1977

After the close of the 1977 Ice Patrol Season, occasional icebergs continued to drift south along the Labrador coast, but none of these survived to reach the Grand Banks. No ice was reported south of 51°N during September and there were no ice reports received by Ice Patrol during October, November or December. The waters off the east coast of Canada never became totally free of sea ice during the early fall. A considerable amount of close to very close pack ice persisted off the coast of Baffin Island (between 65°N and 71°N) throughout September. This was the first time since 1973 that Baffin Bay was not ice free for at least a couple of weeks during the early fall. Some new ice began forming during late September in the northern extremes of Baffin Bay. By mid-October, freeze-up had begun in earnest. Although sea ice growth proceeded at the normal rate, the old ice remaining from last year accounted for an ice pack extent slightly ahead of normal by early November. Sea ice cover extended near the normal limit in December. By the end of December the pack ice along the Labrador coast had reached a point just north of Battle Harbour, Labrador near 53°N.

January 1978

By mid-January, sea ice growth had been retarded to the point that the ice cover was less than on this date for any of the last six years. The Strait of Belle Isle and its eastern approach had become close pack, new and grey ice. The sea ice limit extended only to 51°N and there was no ice east of 54°W. There was little significant ice along the east Newfoundland coast except consolidated ice over southern reaches of the Bay of Exploits. Between 24 January and 10 February, preseason flights were made along the Labrador coast, across Davis Strait, up the Baffin Island coast to Cape Dyer and in the vicinity of Disko Bay, (figure 1). The latitudinal iceberg distribution observed during the flights is illustrated graphically in figure 2. Nearly six times the average number of icebergs were sighted south of 56°N. A large part of these were aground off Battle Harbour, Labrador, just north of Belle Isle. The southernmost iceberg sighted was a small blocky shaped iceberg at 51°30′N 54°45′W on 7 February 1978.*

As a result of a mild winter in Eastern Canada, ice conditions off Labrador and Newfoundland at the end of January were considerably less severe than last year. At this time, the southern limit of East Newfoundland pack ice was lying just north of Notre Dame Bay with some belts and strips extending 20 to 30 miles north and east of Cape Freels. On 31 January, an aircraft reported sighting a "giant" iceberg in position 56°55′N 40°34′W. This berg was probably of East Greenland origin and had been forced out of the primary ocean currents close to the Greenland coast by a prevailing northwesterly wind over this area during January. No ice reports were received from ships during January.

February 1978

Four iceberg sightings were reported by shipping during early February. The southernmost of these was in position 50°45′N 53°10′W. By mid month the Labrador sea ice pack had spread and drifted south into Notre Dame Bay and around Cape Freels with the southern limit reaching a position just off Cape Bonavista. One or two icebergs had drifted south to the vicinity of Cape Freels. The second series of preseason flights were completed between 20 February and 7 March. Tracks flown and iceberg distributions observed during these reconnaissance flights are shown in figure 3. The latitudinal distribution of observed icebergs is presented graphically in figure 4. Observation flights were not conducted between latitudes 52°N and 54°N. Based on sightings made during January preseason flights, a significant number of icebergs existed within this area having been kept aground along the coast north of Belle Isle by the prevailing onshore winds during

* The below normal iceberg count in the vicinity of 65°N is partially accounted for by reduced visibility in this area during the flights.

February. Iceberg counts were below normal in all other areas except for high concentration on the southwest side of Davis Strait. Sea ice conditions off the coast of Newfoundland changed very little during the last two weeks of February. Periods of ice congestion occurred in Notre Dame Bay and a few strips of ice drifted south of Cape Freels. No ice had spread east of 52°W during the month. No icebergs drifted south of 48°N during February.

March 1978

The southernmost icebergs observed during the second series of preseason flights were first located aground in the vicinity of Fogo Island on 4 March. During the last preseason flight on 6 March, several of these icebergs were found adrift with the southernmost located at 49°26'N 53°30'W. A few growlers were sighted southeast of these bergs. The southernmost was at 48°48'N 52°42'W on 4 March. During the first two weeks of March, there were no major changes in the limits of sea ice off Newfoundland. A relatively narrow band of heavy ice remained in proximity to the coast at mid month. Northerly wind-flow carried a tongue of sea ice southward to the latitude of St. John's during the second week of March. The first sea ice to cross 48°N did so on about 12 March. The International Ice Patrol Season officially commenced and the ice reconnaissance detachment deployed to St. John's on 20 March. Reconnaissance flights on 21, 23 and 24 March (figure 5) established the southern and eastern limit of icebergs and growlers in the vicinity of the Grand Banks. The southernmost ice sighted during the month was a growler at 47°27'N 51°43'W on 21 March. This ice probably crossed 48°N on about 18 March with a size large enough to be classified as an iceberg and would have thus been the first iceberg to have crossed 48°N. Very cold temperatures during mid to late March resulted in a considerable amount of new ice growth. Offshore winds in late March caused a seaward expansion of the sea ice pack. The effect of this flow can also be seen in the iceberg distribution as bergs south of 50°N began to pull away from the coast and move toward the core of the Labrador Current. By the end of the month both the eastern limit of sea ice and icebergs had reached 49°W. Although no icebergs were actually sighted south of 48°N during March, a total of 5 icebergs were predicted to have crossed this latitude based on southern growler sightings during March and icebergs observed south of 48°N during early April. This number was significantly below the 1946–1978 average of 33.

April 1978

Ice conditions as they were predicted to exist on 1 April are shown in figure 6. The first iceberg reported south of 48°N during 1978 was sighted on 5 April aground in position 46°59'N 52°50'W. This berg probably crossed 48°N on about 26 March. Flights on 9, 10 and 14 April (figure 7) located a few icebergs south of 48°N but the main concentration was between 48°N and 49°N west of 49°W. On 8 April two different Scandinavian aircraft, on trans-Atlantic flights, reported sighting a large iceberg in positions 57°28'N 36°28'W and 57°35'N 36°40'W respectively. Although the two reports gave slightly different positions, they are assumed to be sightings of the same berg. This iceberg was undoubtably of East Greenland origin blown south by prevailing north winds over the area during March. During early to mid April, the sea ice reached its SE limit for the 1978 season at roughly 47°50'N 49°30'W. The eastern extreme of sea ice was reached on about 14 April at 48°20'N 48°45'W and the southern extreme on 20 April with a few belts and strips reaching 47°N 52°30'W. This sea ice cover was appreciably less than normal, which was one of the primary factors responsible for limiting the number of icebergs that survived to cross 48°N. On the east slope of the Grand Banks, no icebergs drifted south of 47°N or east of 48°W during April. A few bergs drifted south through the Avalon Channel. One of these survived to drift southeast of Cape Race. The remnants of this berg were last sighted on 24 April as 3 growlers near 45°44'N 52°27'W. These growlers were not believed to have survived to reach 45°30'N. The large concentration of icebergs south of 48°N during April was observed during a reconnaissance flight on 29 April (figure 8). Southerly and southwestern winds during the latter part of April retarded the southward drift of icebergs just north of the Grand Banks. No icebergs were reported south of 48°N during the last week in April and the first two weeks in May with the exception of a few icebergs along the coast west of 52°W (figure 9). By month's end, the sea ice had retreated well north of 48°N. A total of 28 icebergs were estimated to have crossed 48° during the month of April.

May 1978

By mid month, the remaining sea ice was north of Cape Freels except for a few dissipating strips and bands immediately to the east and southeast of Cape Freels. At the end of May, no sea ice existed south of 51°30′N. The location of icebergs south of 50°N during the second week in May was well defined by the series of reconnaissance flights on 9, 10 and 13 May (figure 10). Offshore winds during May moved the icebergs between 48°N and 50°N further offshore and into the southeastward flowing Labrador Current. This resulted in a rapid southeasterly expansion of the iceberg limit (figure 11). For the first time in 1978, the primary concentration of icebergs was drifting down the eastern slope of the Grand Banks. Although icebergs were present in substantial numbers, they deteriorated rapidly in the warming surface waters in this area. Only a few of the largest bergs survived to cross 46°N. The southernmost and easternmost icebergs reported during the month were both sighted on 29 May at 45°43′N 47°15′W and 48°22′N 44°31′W respectively. The second berg was also the easternmost reported during 1978. A total of 35 icebergs was estimated to have crossed 48°N during May. Of these icebergs, one very large tabular berg is particularly worthy of note. This berg was first spotted on 9 May at 48°53′N 51°32′W. It was approximately 300 meters wide by 700 meters long. With its very distinguishable rectangular shape, this iceberg was easily differentiated from other bergs in the area. For this reason, positive resightings of this same berg were possible for a period of over two months. This iceberg alone was responsible for keeping the Ice Patrol in operation for an additional month. An iceberg similar to this berg in both size and shape was responsible for keeping the 1976 Ice Patrol Season active until July of that year. (See the 1976 Ice Patrol Report CG–188–32, Appendix B.)

June 1978

The melting of all sea ice within the Strait of Belle Isle was complete by the middle of June. Iceberg conditions on the Grand Banks as they existed at the beginning of June are shown in figure 12. Fog, producing zero to near zero visibility, persisted on the eastern slope of the Grand Banks from 12 June to 7 July prohibiting effective visual ice reconnaissance in the area for 3½ weeks. Flights on 8, 11 and 12 June (figure 13) provided the last complete coverage of the southern ice limits until they were redefined by flights during the second and third weeks in July. Icebergs sighted on 12 June by the Ice Patrol aircraft and two sightings by ships near 46°N 46°W on 17 June were the last reports of icebergs south of 48°N received during 1978 with the exception of the large tabular iceberg discussed earlier. The southernmost iceberg reported during 1978 was a small tilted blocky shaped iceberg at 44°20′N 48°44′W on 11 June. A total of 7 icebergs crossed 48°N during June.

July-August 1978

One iceberg remained south of 48°N at the beginning of July. This large tabular berg (figure 14) maintained its flat almost perfectly rectangular shape past at least 2 July. When resighted on 7 July, it had broken into two medium-size tilted-blocky-shaped bergs, three small blocky bergs and a number of growlers. Its deterioration proceeded rapidly from that point. By 14 July only one medium drydocked-shaped iceberg, one small drydock berg and one growler remained. This iceberg was predicted to have completely melted by 18 July. Notice was given to mariners on that date that there was no known ice south of 48°30′N and none was expected to survive to drift south of 47°N during the remainder of 1978. The ice reconnaissance detachment returned from St. John's on 20 July. No icebergs were known to have crossed 48°N during July and August 1978. Scattered berg reports for northern Labrador Sea and the approaches to the Strait of Belle Isle were received as usual.

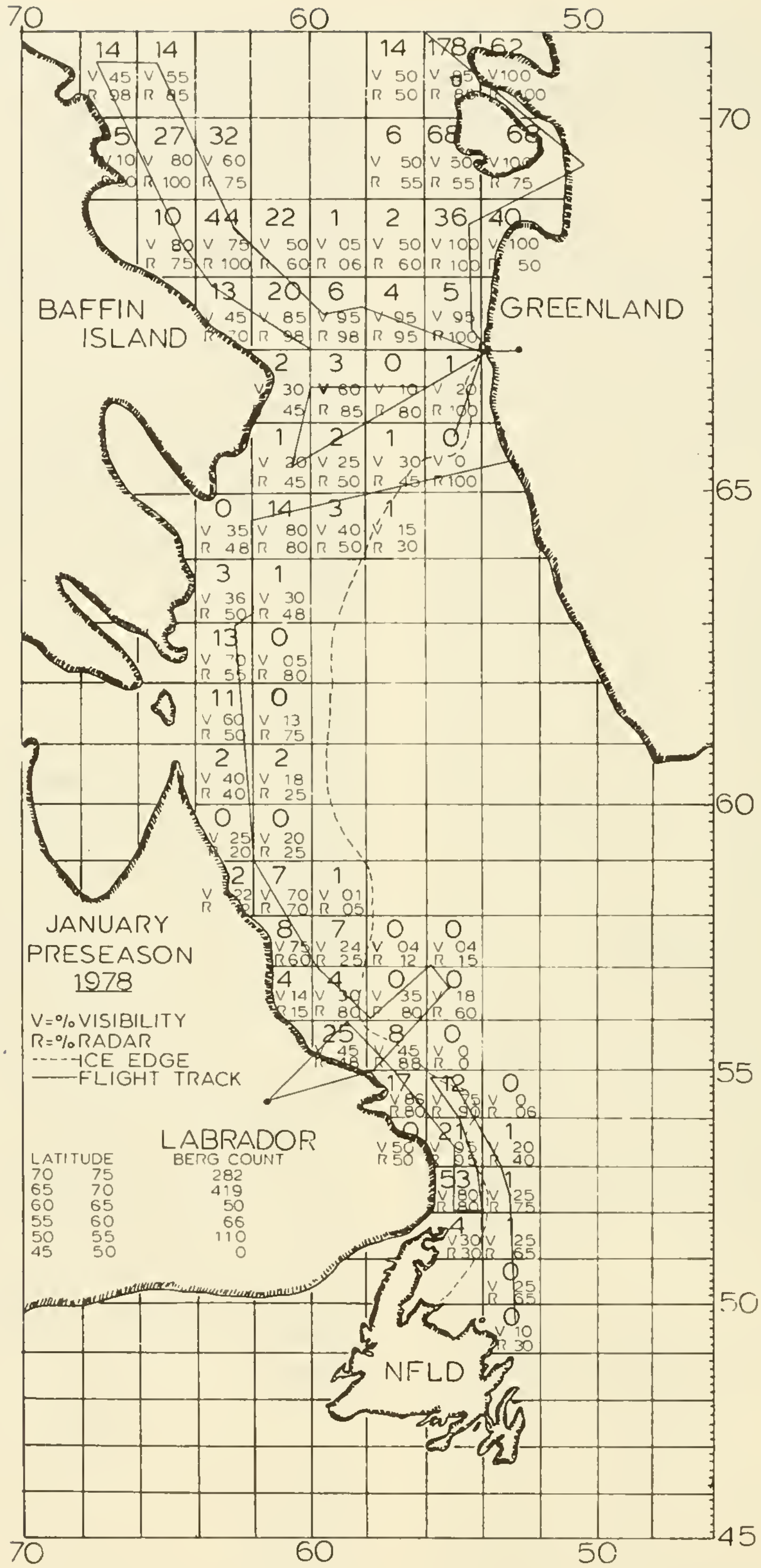

BAFFIN ISLAND
GREENLAND
JANUARY PRESEASON 1978
V=% VISIBILITY
R=% RADAR
ICE EDGE
FLIGHT TRACK
LABRADOR
NFLD
LATITUDE BERG COUNT
70 75 282
65 70 419
60 65 50
55 60 66
50 55 110
45 50 0

Figure 1

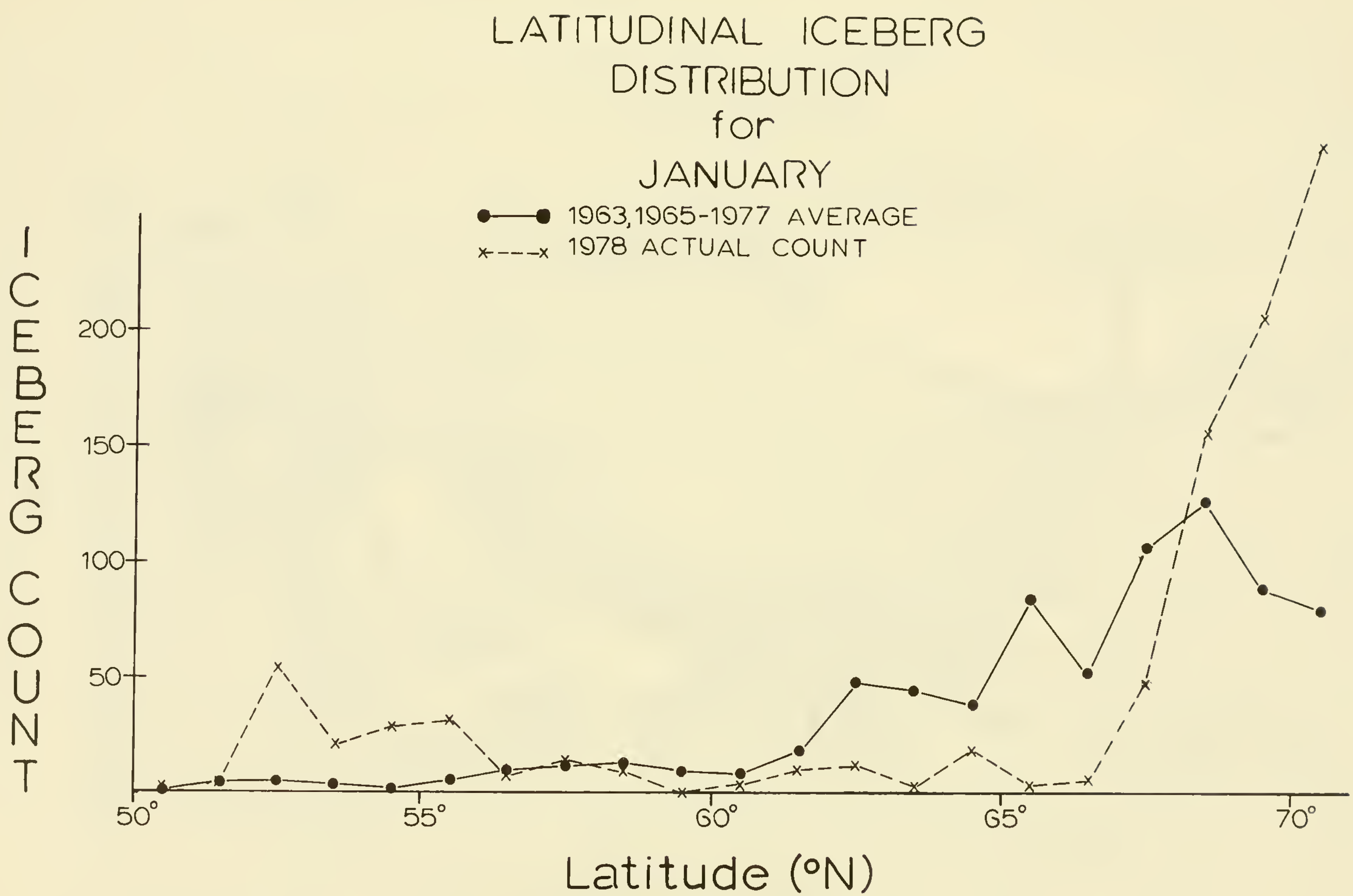
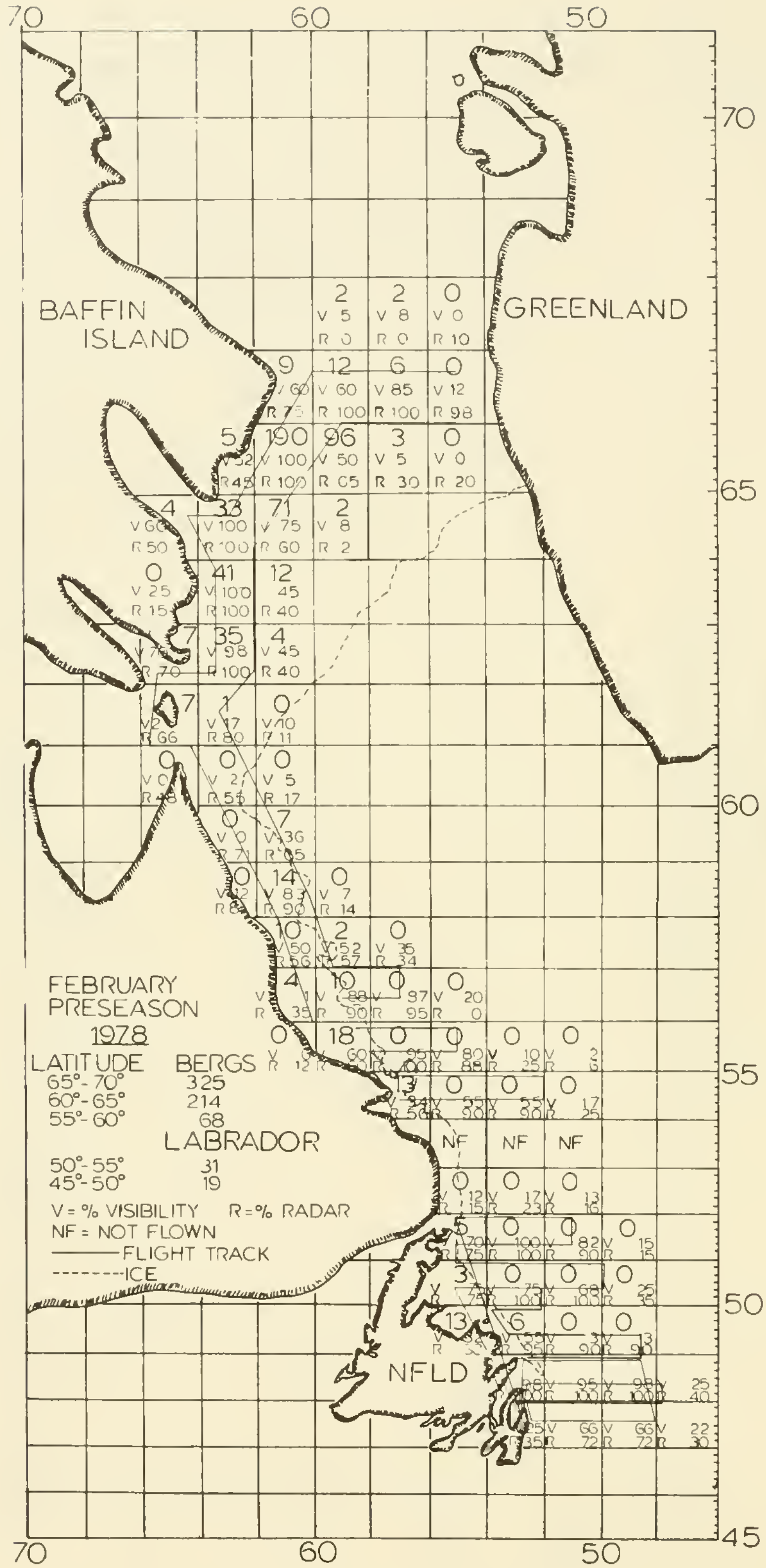

LATITUDINAL ICEBERG
DISTRIBUTION
for
JANUARY
1963,1965-1977 AVERAGE
1978 ACTUAL COUNT
ICEBERG COUNT
200
150
100
50
50°
55°
60°
65°
70°
Latitude (°N)

Figure 2



BAFFIN ISLAND
GREENLAND
LABRADOR
NFLD
FEBRUARY PRESEASON 1978
LATITUDE BERGS
65°-70° 325
60°-65° 214
55°-60° 68
50°-55° 31
45°-50° 19
V = % VISIBILITY R = % RADAR
NF = NOT FLOWN
FLIGHT TRACK
ICE

Figure 3

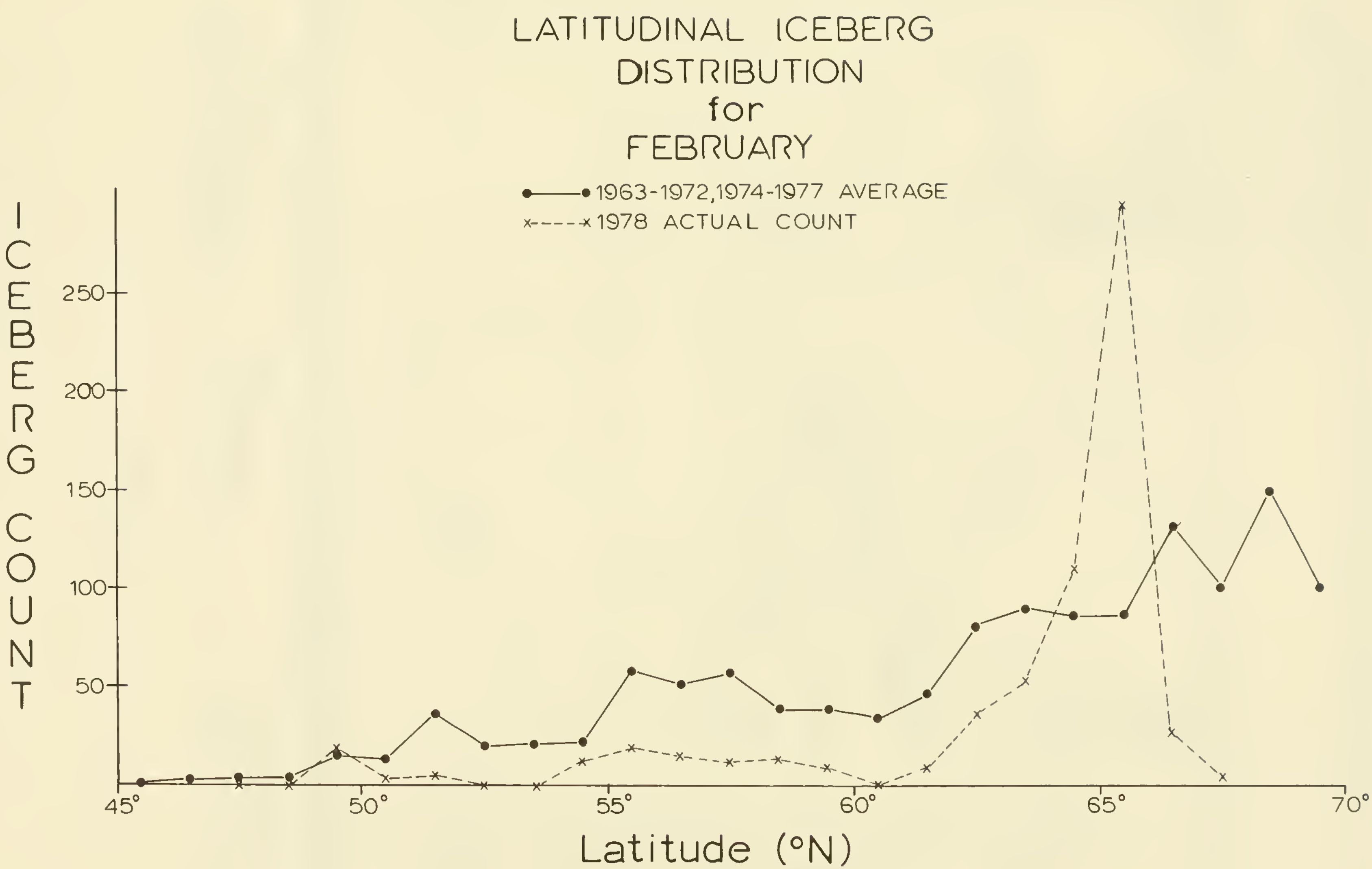

LATITUDINAL ICEBERG
DISTRIBUTION
for
FEBRUARY
1963-1972,1974-1977 AVERAGE
1978 ACTUAL COUNT
ICEBERG COUNT
250
200
150
100
50
45°
50°
55°
60°
65°
70°
Latitude (°N)

Figure 4

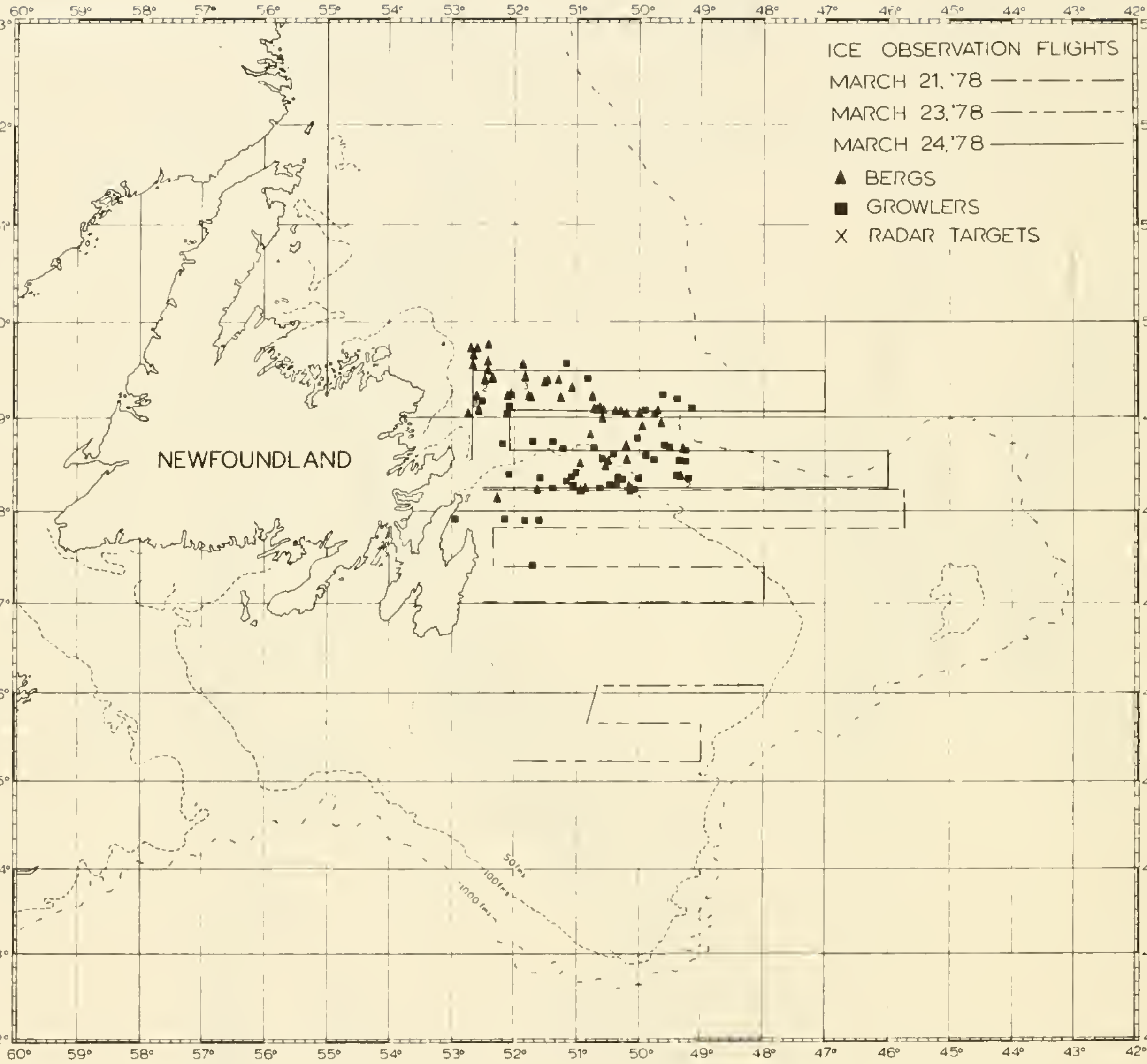
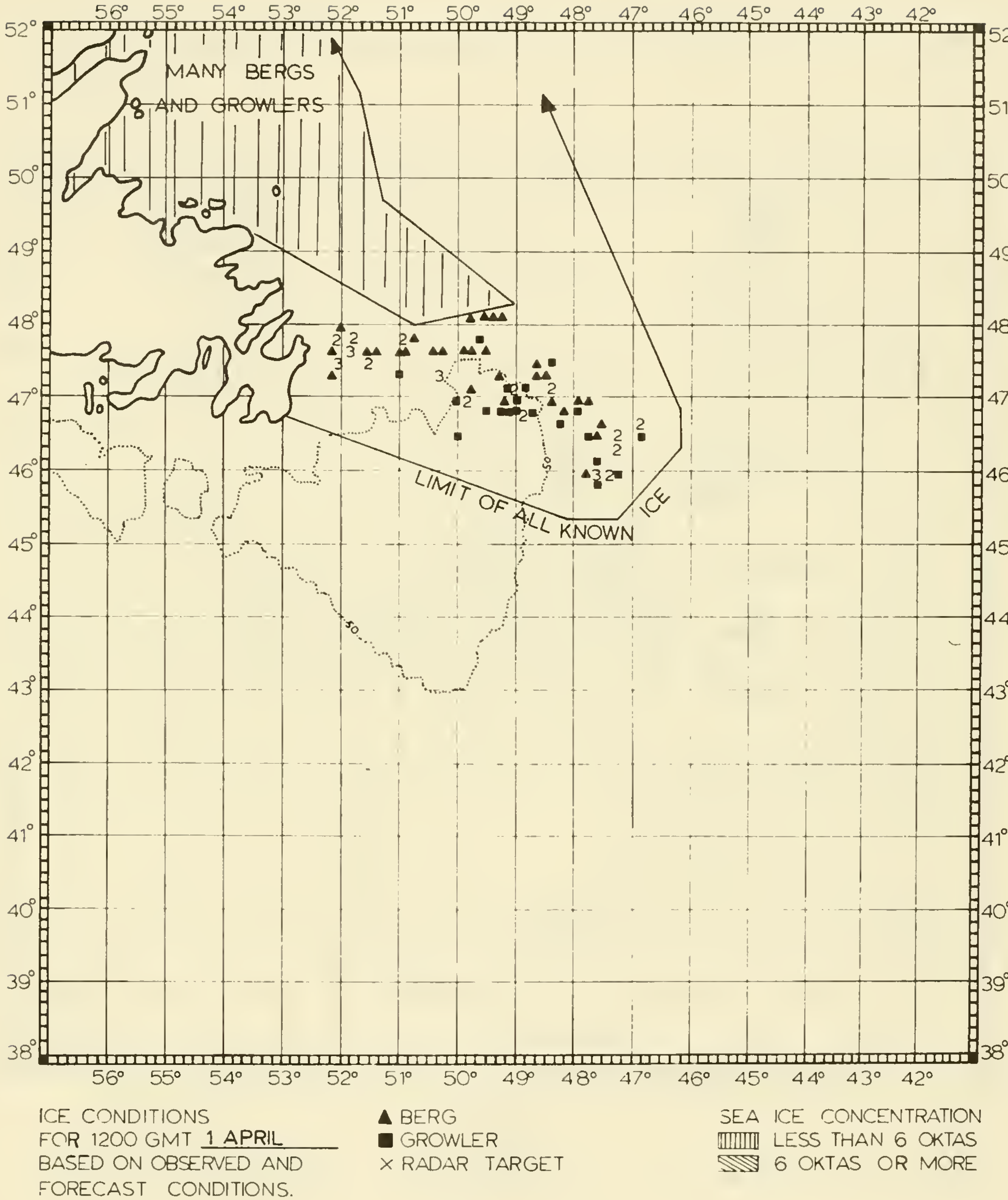

ICE OBSERVATION FLIGHTS
MARCH 21, '78
MARCH 23, '78
MARCH 24, '78
BERGS
GROWLERS
X RADAR TARGETS
NEWFOUNDLAND

Figure 5



MANY BERGS
AND GROWLERS
LIMIT OF ALL KNOWN ICE
ICE CONDITIONS
FOR 1200 GMT 1 APRIL
BASED ON OBSERVED AND
FORECAST CONDITIONS.
▲ BERG
■ GROWLER
× RADAR TARGET
SEA ICE CONCENTRATION
LESS THAN 6 OKTAS
6 OKTAS OR MORE

Figure 6

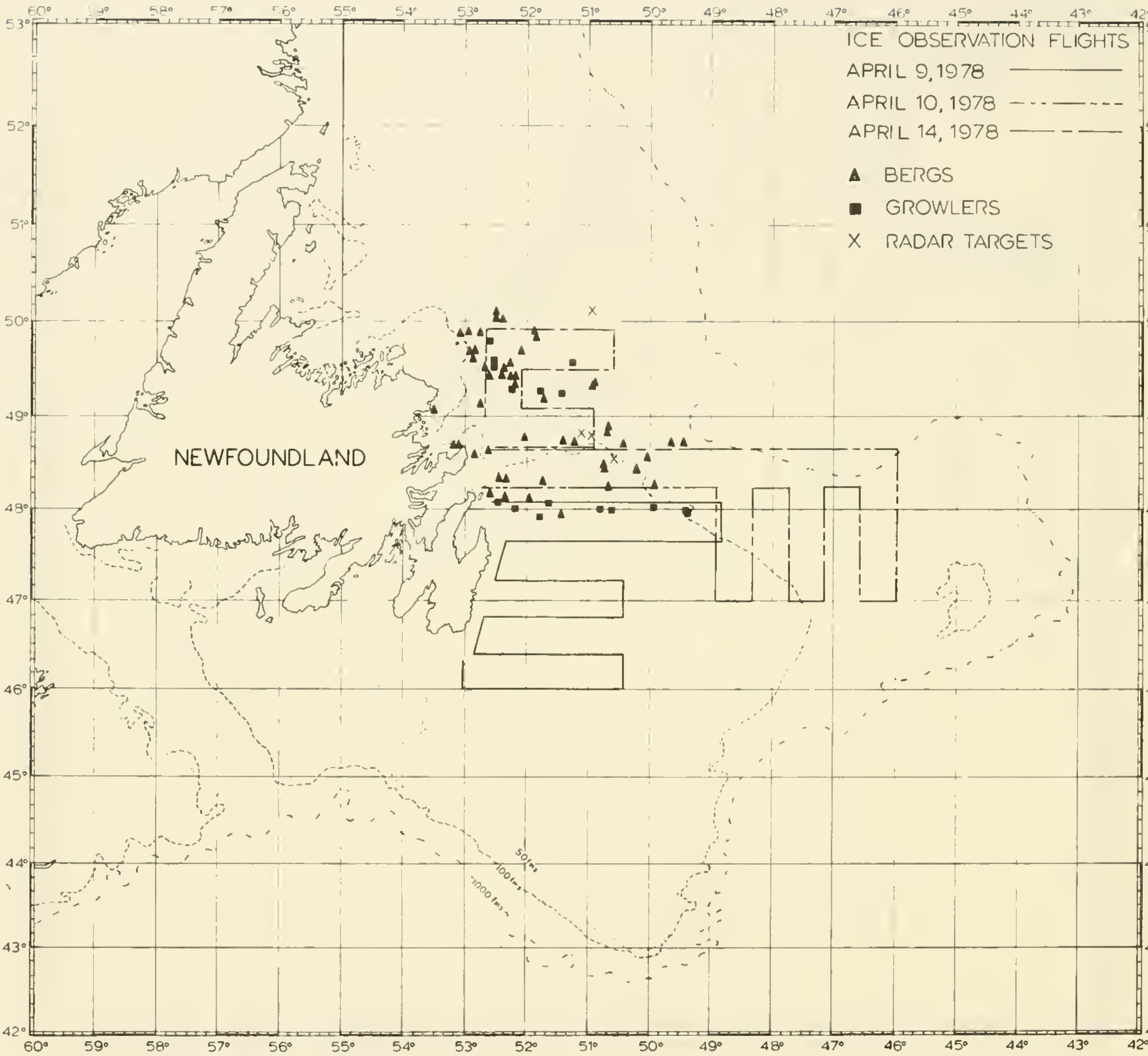
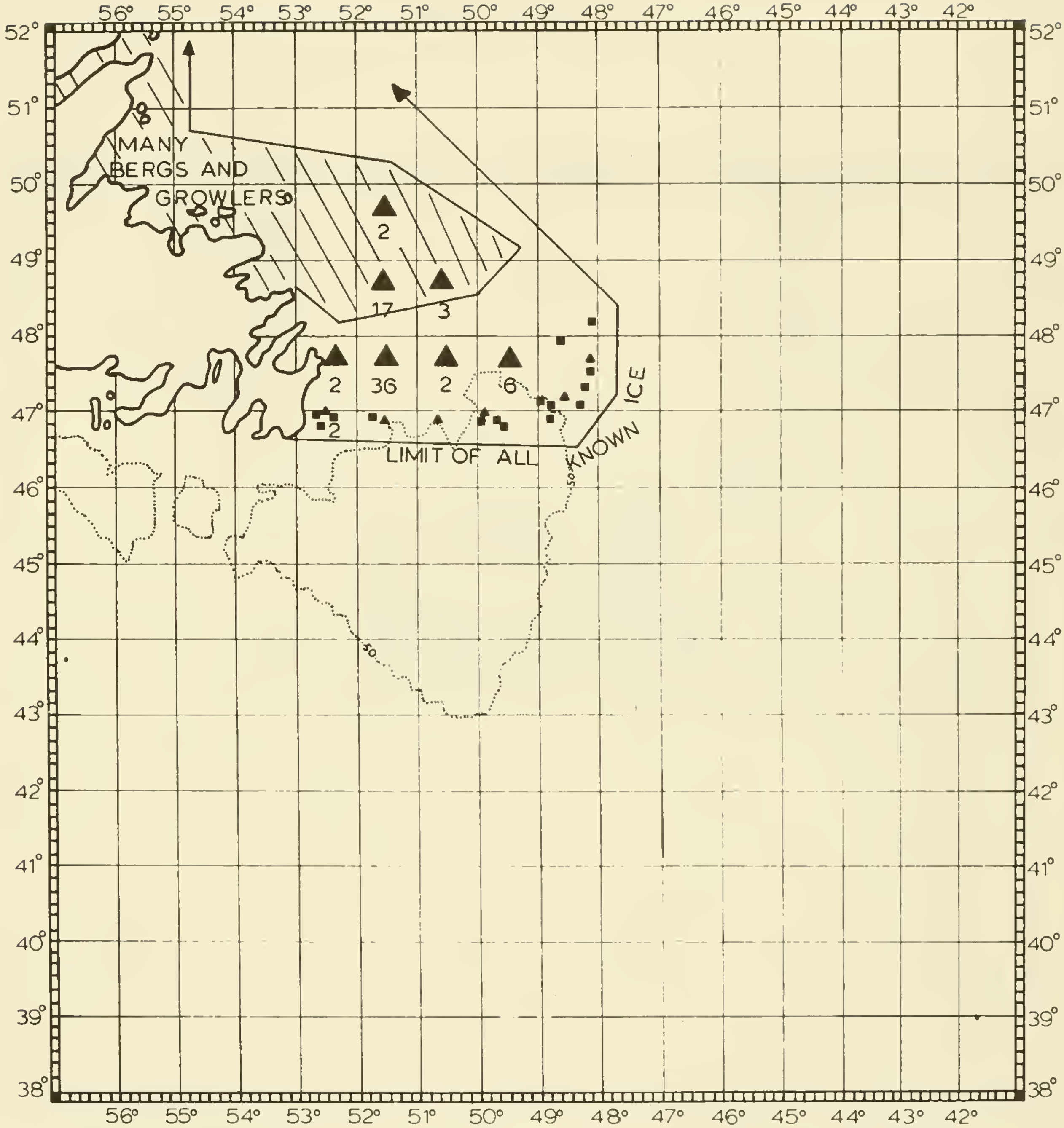

ICE OBSERVATION FLIGHTS
APRIL 9, 1978
APRIL 10, 1978
APRIL 14, 1978
BERGS
GROWLERS
X RADAR TARGETS
NEWFOUNDLAND
50 fms
100 fms
1000 fms

Figure 7



ICE CONDITIONS
FOR 1200 GMT 29 APRIL
BASED ON OBSERVED AND
FORECAST CONDITIONS.

▲ BERG
■ GROWLER
× RADAR TARGET

SEA ICE CONCENTRATION
LESS THAN 6 OKTAS
6 OKTAS OR MORE

Figure 8

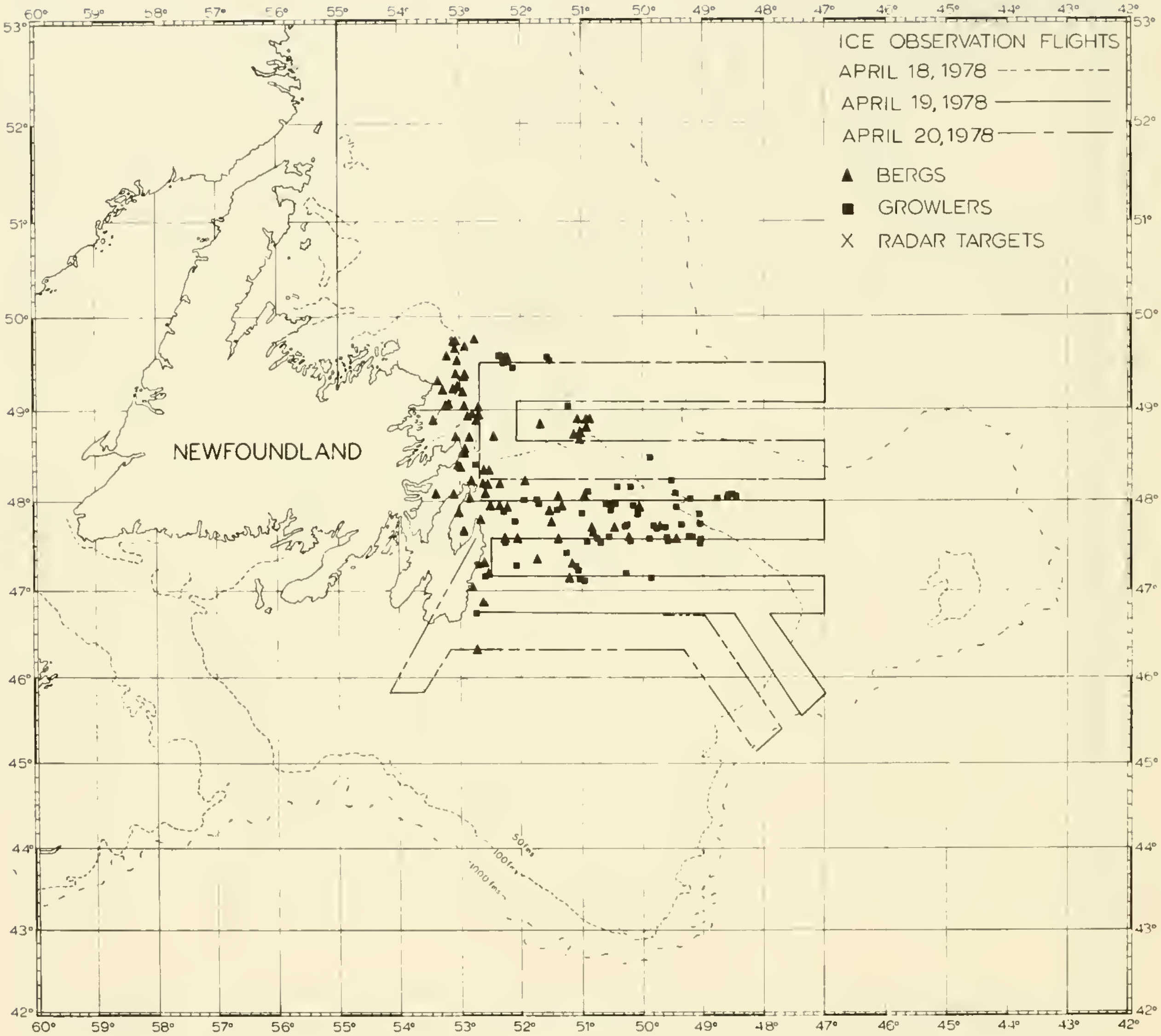

ICE OBSERVATION FLIGHTS
APRIL 18, 1978
APRIL 19, 1978
APRIL 20, 1978
BERGS
GROWLERS
X RADAR TARGETS
NEWFOUNDLAND

Figure 9

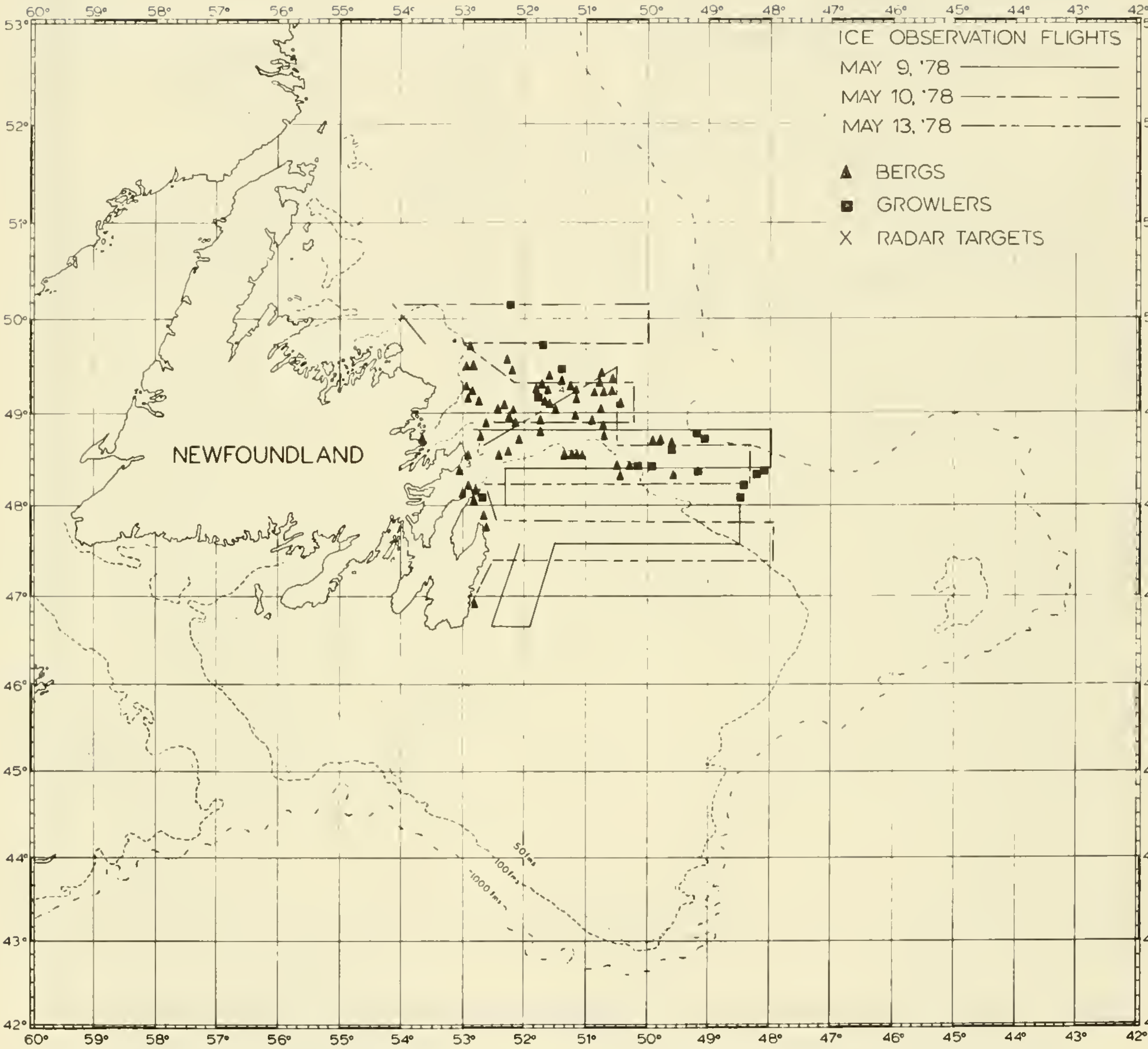
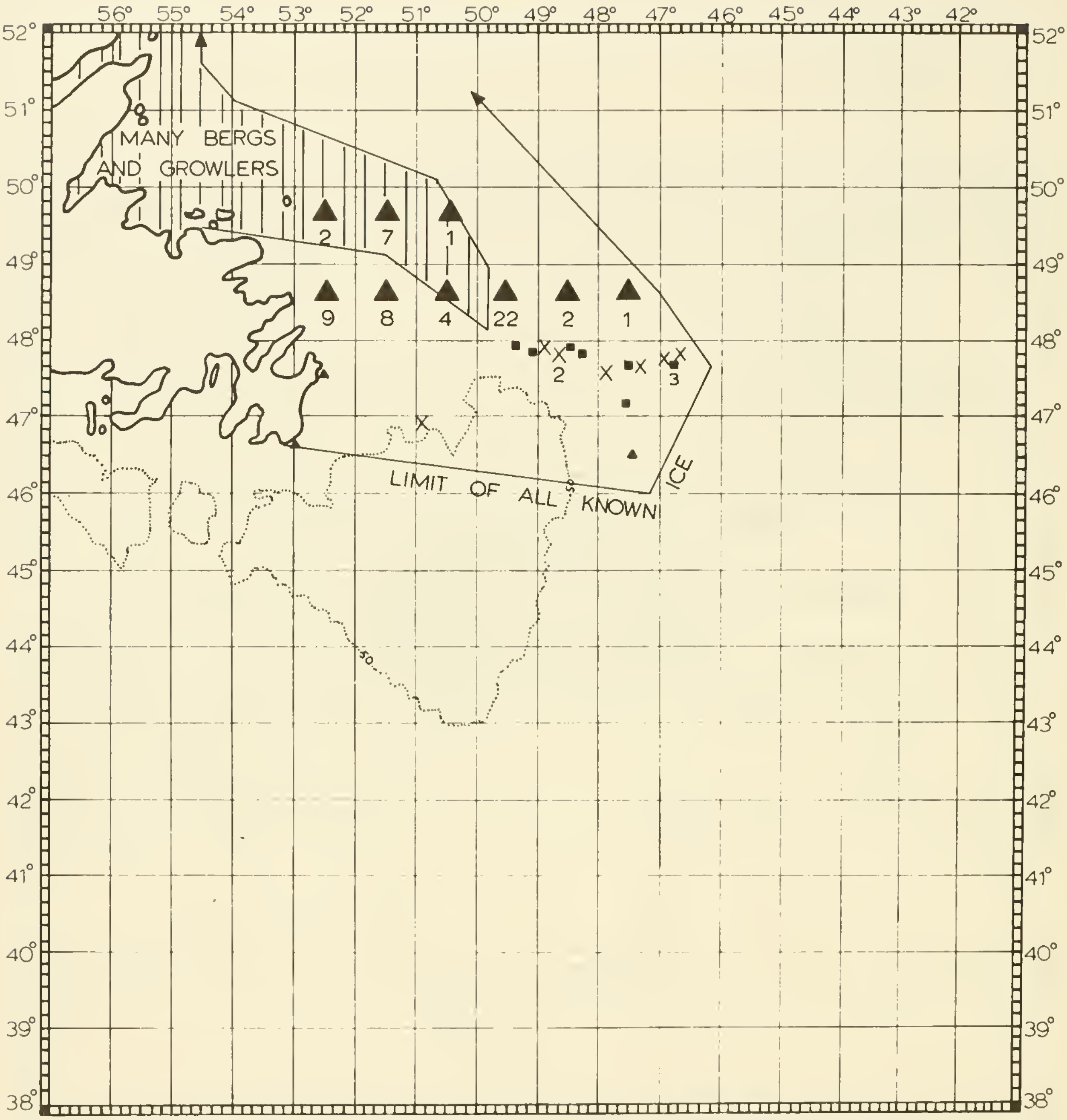

ICE OBSERVATION FLIGHTS
MAY 9, '78
MAY 10, '78
MAY 13, '78
BERGS
GROWLERS
X RADAR TARGETS
NEWFOUNDLAND
60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49° 48° 47° 46° 45° 44° 43° 42°
53° 52° 51° 50° 49° 48° 47° 46° 45° 44° 43° 42°
50 fms
100 fms
1000 fms

Figure 10

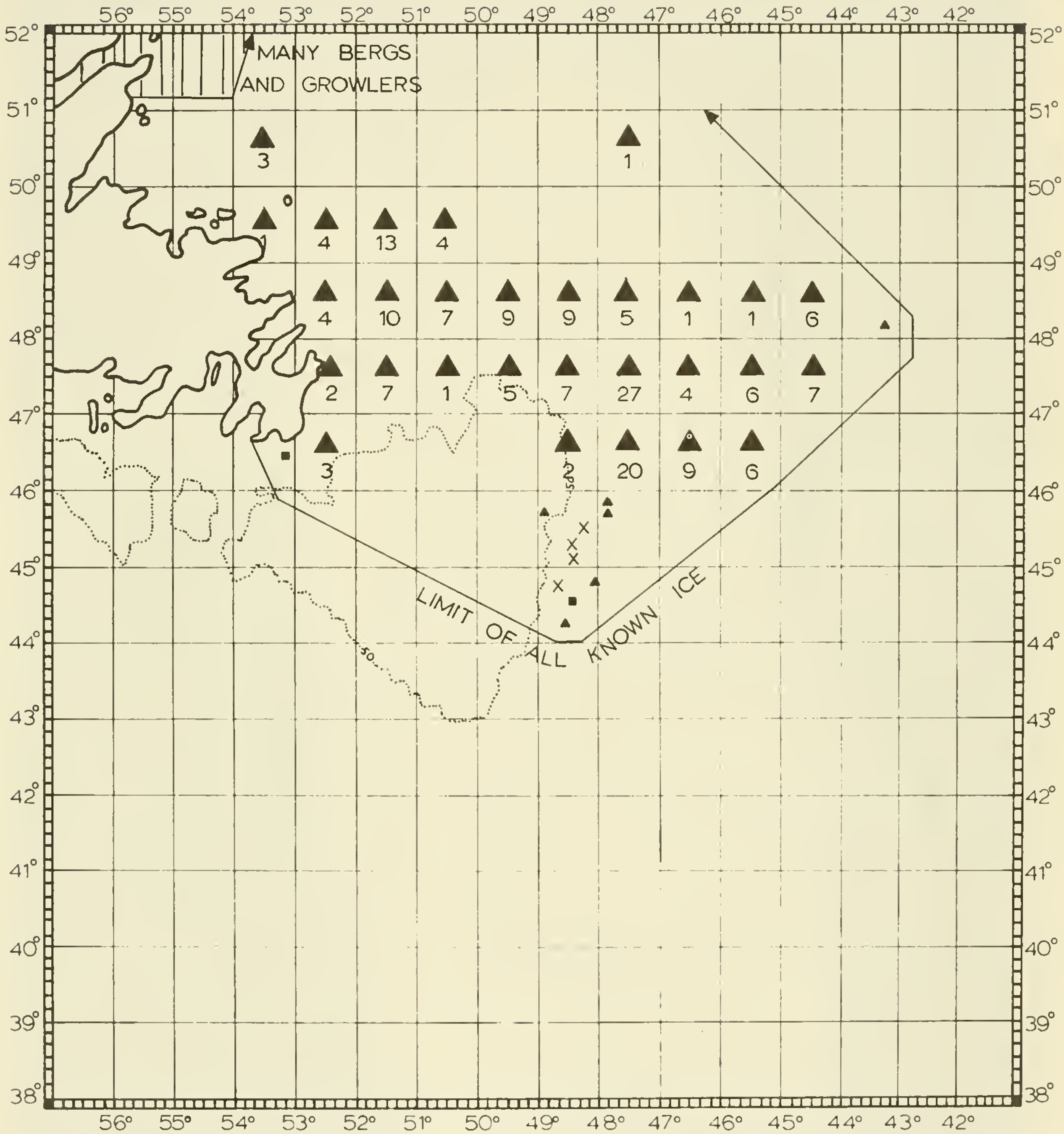


ICE CONDITIONS
FOR 1200 GMT 17 MAY
BASED ON OBSERVED AND
FORECAST CONDITIONS.

▲ BERG
■ GROWLER
× RADAR TARGET

SEA ICE CONCENTRATION
LESS THAN 6 OKTAS
6 OKTAS OR MORE

Figure 11



ICE CONDITIONS
FOR 1200 GMT 06 JUNE
BASED ON OBSERVED AND
FORECAST CONDITIONS.

▲ BERG
■ GROWLER
× RADAR TARGET

SEA ICE CONCENTRATION
LESS THAN 6 OKTAS
6 OKTAS OR MORE

Figure 12

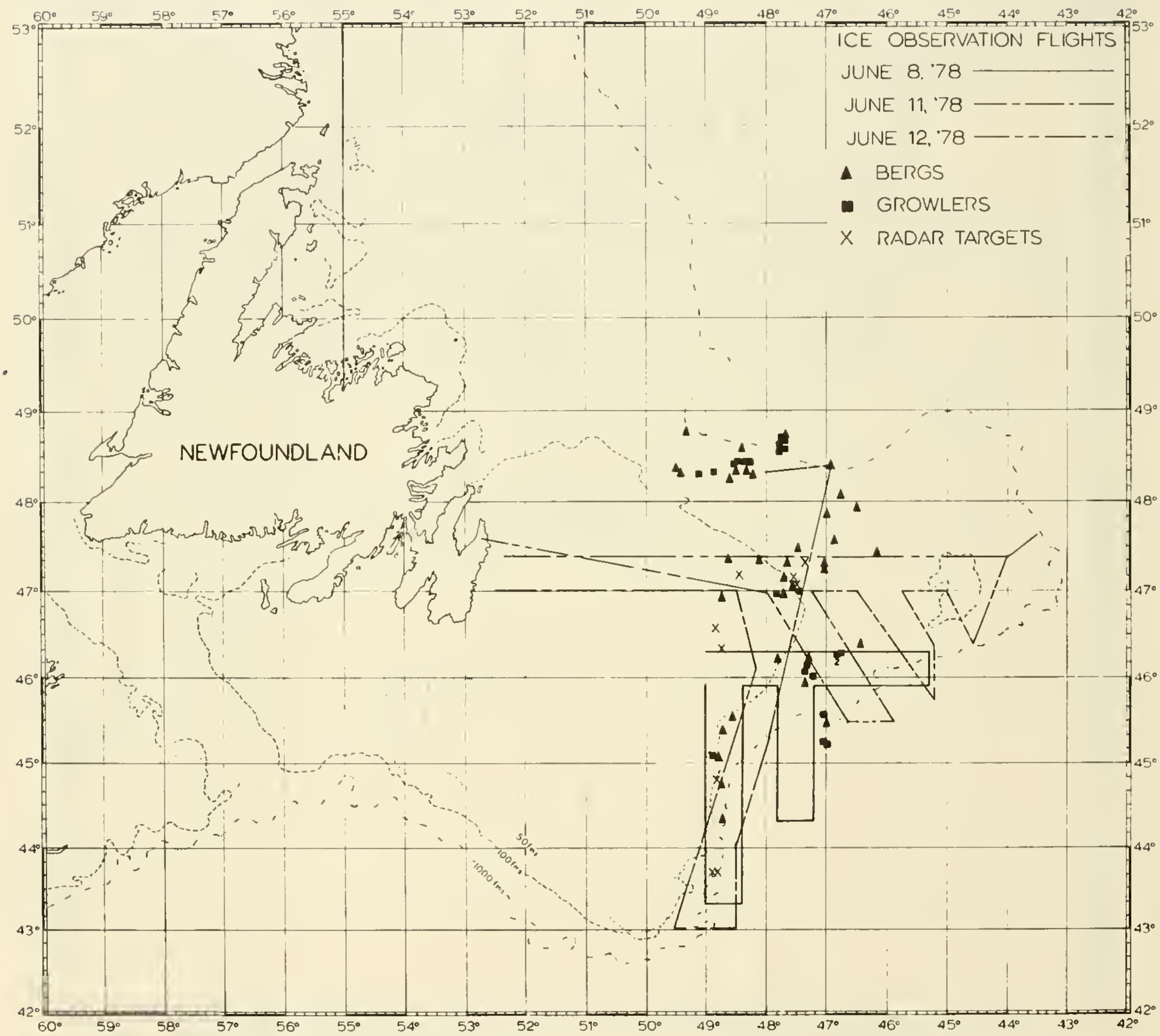

ICE OBSERVATION FLIGHTS
JUNE 8, '78
JUNE 11, '78
JUNE 12, '78
BERGS
GROWLERS
RADAR TARGETS
NEWFOUNDLAND
60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49° 48° 47° 46° 45° 44° 43° 42°
53° 52° 51° 50° 49° 48° 47° 46° 45° 44° 43° 42°

Figure 13

Figure 14

APPENDIX A
OCEANOGRAPHIC CONDITIONS 1978

LT C. R. WEIR
DR. D. G. MOUNTAIN
MR. R. M. HAYES
U.S. Coast Guard Oceanographic Unit

INTRODUCTION

The International Ice Patrol (IIP) oceanographic mission in 1978 consisted of two USCGC EVERGREEN (WAGO 295) cruises to the Grand Banks of Newfoundland from 30 March to 23 April and 1-26 June 1978. The first cruise provided sea current data from hydrographic surveys for the computer prediction of iceberg drift by Commander, International Ice Patrol. Two satellite-tracked drogued buoys (BTT's) were deployed in a cooperative project with the Woods Hole Oceanographic Institution. The information obtained was used to verify and improve operational iceberg drift by making Lagrangian measurements of the sea current to compare with estimates obtained by the hydrographic methods. The second CGC EVERGREEN cruise was dedicated to an on-going research project by the Coast Guard Research and Development Center on iceberg drift and deterioration. For the second year a researcher from the University of Washington, Seattle, Washington conducted an investigation examining the physical aspects of iceberg deterioration.

Two additional projects were accomplished during the CGC EVERGREEN cruises. A Geophysical Ocean Bottom Instrument (GOBI) which measured pressure, water temperature, water current, and gravity was deployed and recovered for the Lamont-Doherty Geological Observatory in the Laurentian Fan west of the Tail of the Banks. During transit to and from the Grand Banks on both cruises an XBT survey was made across the mouth of the Gulf of Maine for the National Marine Fisheries Service.

OPERATIONAL DYNAMIC SURVEYS

Methods and Materials—The dynamic surveys were accomplished using a Plessey Environmental Systems, Inc. Conductivity/Temperature/Depth (CTD), Model 9040, Environmental Profiling System. The data were recorded and processed on a Wang Laboratories, Inc. Model 600-14-TP Programmable Calculator, a Wang Model 629 Dual Tape Drive, and a Wang Counting Interface (Electronics Lab USCG Station, Alexandria, Virginia).

Corrections were applied to the CTD system temperature and salinity data from measurements made by Nansen bottles with deep-sea reversing thermometers at the bottom of each cast and from surface bucket samples. Salinity was determined with a Guildline Instruments, Inc. (Larchmont, N.Y.) Model 8400 Autosal. The temperature quality control value of $-0.02°C$ was determined from the average difference between the CTD and the Nansen bottle data, and was applied as a constant correction with depth. The salinity quality control values were similarly determined from the Nansen bottle data and the surface bucket samples. Both the top and bottom salinity correction values were $-0.08°/_{oo}$.

Standard Sections—IIP standard monitoring sections A2C, A2B, and A2A were occupied between 6-9 April. Sections A1B, A1C, and a 16 station special survey were completed between 13-17 April. Section A2 was begun, but due to a hydraulic system casualty only 8 stations were occupied. The special survey [see Table 1A for station locations] was arranged to delineate the structure of the Labrador Current as it approached Flemish Pass.

The dynamic topography [Fig. 1A] indicated that the Labrador Current entered the survey area flowing southeastward along the steep continental slope. The current followed the bottom topography turning south through Flemish Pass and along the eastern edge of the Grand Banks similarly to the average observed conditions [Scobie and Schultz, 1976]. The special survey indicated that the

current followed the bottom topography around the sharp beak-like feature near 48°N, 47°W. However, the drift of a BTT buoy through this area suggests that the water motions did not follow this bathymetric feature. The flow of water off of the Grand Banks at 46°N indicated in the dynamic topography, while possibly real, is likely a result of the sampling methods.

Table 1A—Special Divergence Survey Stations

Station Number	*Latitude*	*Longitude*
1	49°00′N	46°20′W
2	49°00′N	47°00′W
3	48°00′N	46°20′W
4	48°20′N	46°20′W
5	48°40′N	46°20′W
6	48°40′N	46°40′W
7	48°30′N	46°40′W
8	48°20′N	46°40′W
9	48°10′N	46°40′W
10	48°00′N	46°40′W
11	48°00′N	46°50′W
12	48°00′N	47°00′W
13	48°10′N	47°00′W
14	48°20′N	47°00′W
15	48°30′N	47°00′W
16	48°40′N	47°00′W

BTT BUOYS

A joint project with Woods Hole Oceanographic Institution (WHOI) was conducted during the 1978 IIP season. WHOI supplied two BTT buoys of the type manufactured by Polar Research Labs, Inc., Santa Barbara, California. Details of this buoy are covered in CG–188–31. Both buoys were deployed by the CGC EVERGREEN (WAGO 295) in the Ice Patrol area. They contained battery voltage monitors, sea surface temperature sensors, and drogue tension monitors. Nylon line, 1½ inches in diameter and weighted at the bottom end with 50 pounds of chain, was used to increase water drag.

The first buoy, platform I.D. 264, was deployed in the North Atlantic Current at 0625 (GMT) on 5 April at 42°–39.5′N, 45°–28.0′W. The deployment criterion was that the buoy should be deployed in the area of steeply sloping isotherms east of the Grand Banks where the 10° isotherm is at a depth of 200–300 meters. Before the CGC EVERGREEN reached the area it was thought that the deployment criterion would be found near 42°–44′N, 42°–48′W. However, an XBT survey found the North Atlantic Current much further to the west.

A plot of the buoy's trajectory is shown in figure 2A. By 1323 (GMT) 9 July this buoy had drifted eastward to 40°47′N, 39°13′W. This position is well to the east of the IIP area and data collected after that time have no direct application to IIP operations. Buoy drifts such as these show that the currents in this area are not as straightforward as once thought. Although this is a preliminary report, it should be noted that currents as far north as 44°N are not totally independent of currents as far south as 39°N. The second buoy, platform I.D. 731, was deployed in the Labrador Current along standard section A1B at 1317 (GMT) on 13 April in position 48°–33.7′N, 49°–02.4′W. The deployment criterion for this buoy was to place it in the Labrador Current along the 500m contour. A plot of this buoy's track through June 27th is shown in figure 3A.

The first significant feature is the buoy's general track down along the eastern edge of the Grand Banks. At the time of deployment it was not known whether the buoy would go south through Flemish Pass or head east, north of Flemish Cap. Because this information is critical in iceberg drift, work will continue with drift models that can account for a drift object's motion north and west of Flemish Cap.

A second feature of the buoy's trajectory that is important to IIP is the smaller scale motions that can be seen along the trackline at about 47°–23′N,45°–42′N, and again at 42°–50′N. These motions cannot be explained by looking at the dynamic topography. Although the buoy returns to a course predicted by the dynamic topography, it ends up being miles north of where it would have been had it not made these excursions. Preliminary analysis of wind generated currents also indicate that they cannot explain what is observed. Whatever the forces are that cause these motions, they may contribute significantly to the errors in any drift prediction model if they are not included.

Another area of large uncertainty in drift prediction is near 44°–50′N, 48°–20′W. It is in this area that the normal dynamic topography shows the Labrador Current as two branches (Scobie and Schultz, 1976). The main branch of the Labrador Current continues south along the Grand Banks. The other section travels in a northeasterly direction. If drift objects travel south through Flemish Pass it is not known which branch of the Labrador Current they will follow. In 1976 the BTT buoy, platform I.D. 0177, was deployed along standard section A2 in the Labrador Current (Super and

Ketchen, 1978). This buoy followed the main branch of the Labrador Current and traveled south. One year later another BTT buoy, platform I.D. 0647, was deployed very close to the 1976 location (Knutson and Neill, 1978). This buoy followed the northeasterly branch. Platform I.D. 0731 was deployed further upstream but passed about 10 miles to the west of the 1976 and 1977 deployment sites. This buoy followed the Labrador Current south. The mechanism which determines whether drift objects go south or northeasterly is unknown.

On 28 June BTT 0731 was recovered by the Woods Hole Oceanographic Institution research vessel Atlantis II.

REFERENCES

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Scobie, R. W. and R. H. Schultz (1976). Oceanography of the Grand Banks Region of Newfoundland March 1971-December 1972. U.S. Coast Guard Oceanographic Report No. 70, CG-373-70.

Super, A. D. and H. G. Ketchen. Report of the International Ice Patrol Service in the North Atlantic Ocean. U.S. Coast Guard Bulletin No. 62, CG-188-31.

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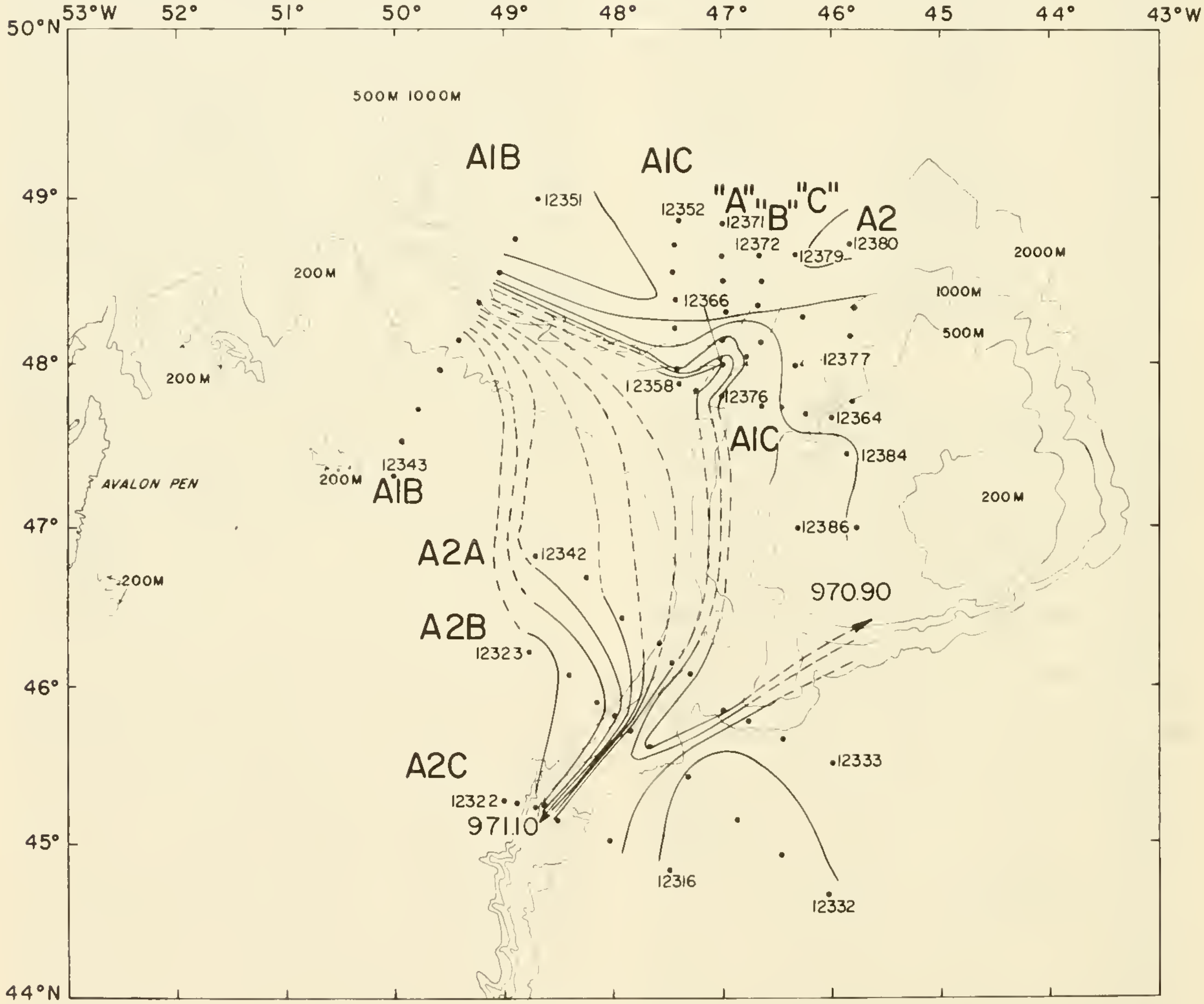


Figure 1A

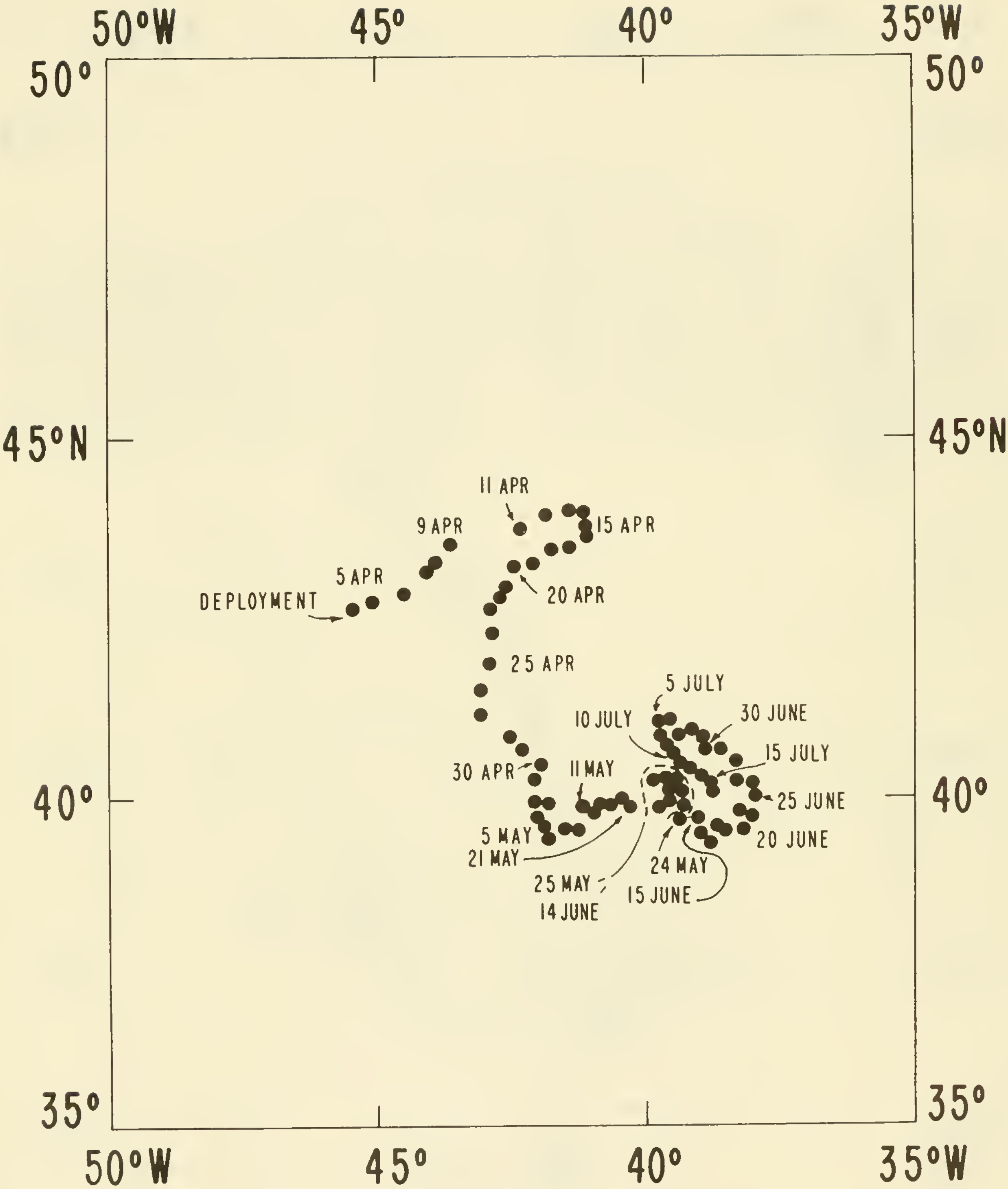

50°W
45°
40°
35°W
50°
45°N
40°
35°
DEPLOYMENT
5 APR
9 APR
11 APR
15 APR
20 APR
25 APR
30 APR
5 MAY
11 MAY
21 MAY
24 MAY
25 MAY
14 JUNE
15 JUNE
20 JUNE
25 JUNE
30 JUNE
5 JULY
10 JULY
15 JULY

Figure 2A

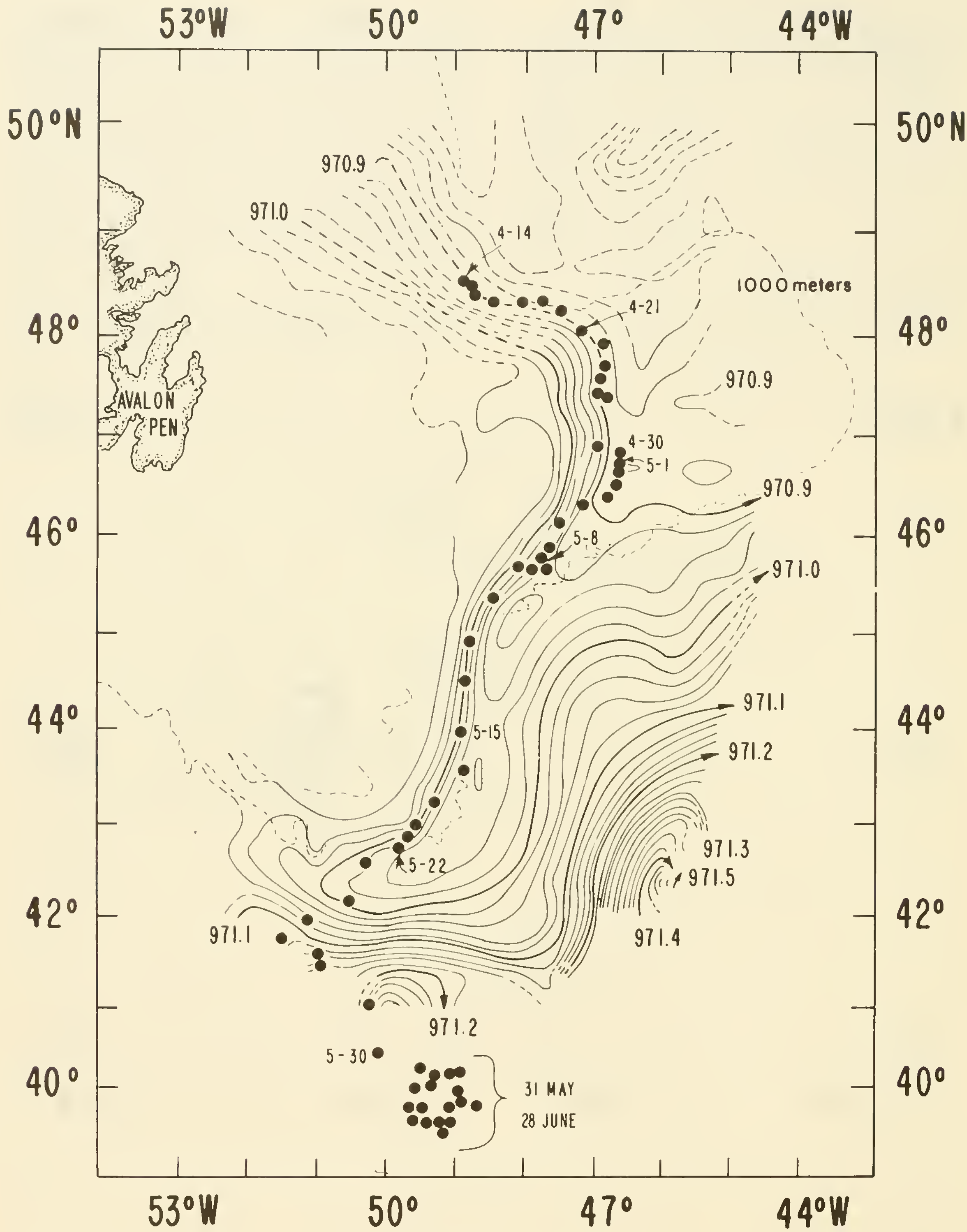
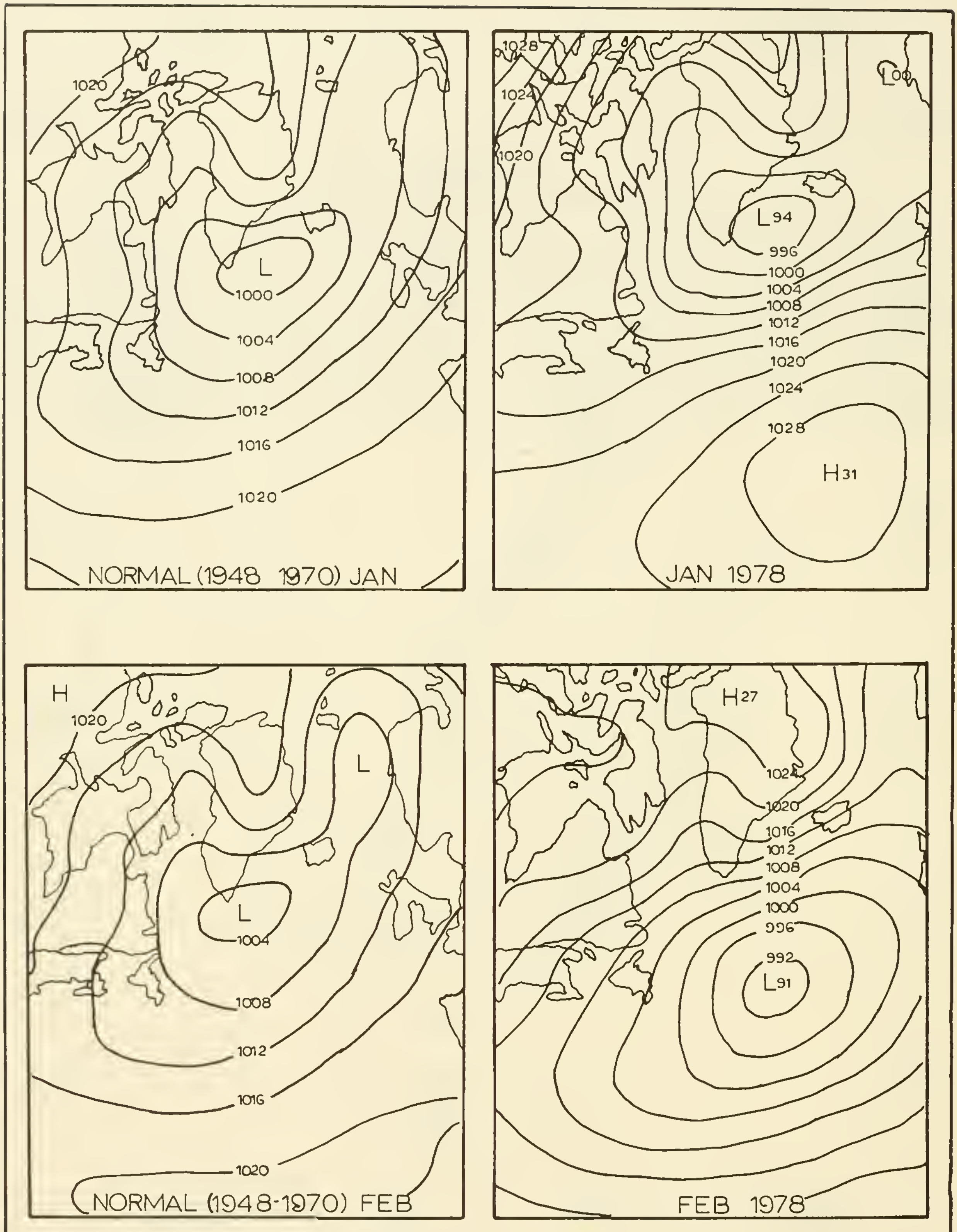

53°W
50°
47°
44°W
50°N
48°
46°
44°
42°
40°
970.9
971.0
4-14
1000 meters
4-21
AVALON PEN
970.9
4-30
5-1
970.9
5-8
971.0
971.1
5-15
971.2
971.3
5-22
971.5
971.4
971.1
971.2
5-30
31 MAY
28 JUNE

Figure 3A

APPENDIX B
METEOROLOGICAL CONDITIONS

The drift of icebergs can be explained through hindsight by a review of the meteorological conditions during an ice patrol season. Circulation patterns, the intensity and duration of prevailing winds and temperature distribution, are factors that influence the drift of icebergs toward or away from 48°N to become a threat to North Atlantic shipping. Figures 1–B through 4–B show the monthly sea surface pressures (from January to August). Figures 6B through 7B and figures 8B through 9B show pressure gradients across selected sections (shown in figure 5B) and melt/frost degree days, respectively. A review suggests that these combined factors, in particular the prevailing winds that pushed the icebergs out of the mainstream of the Labrador Current, prevented all but 75 bergs from crossing 48°N.



1020
L
1000
1004
1008
1012
1016
1020
NORMAL (1948 1970) JAN
1028
1024
1020
L94
996
1000
1004
1008
1012
1016
1020
1024
1028
H31
JAN 1978
H
1020
L
L
1004
1008
1012
1016
1020
NORMAL (1948-1970) FEB
H27
1024
1020
1016
1012
1008
1004
1000
996
992
L91
FEB 1978

Figure 1B

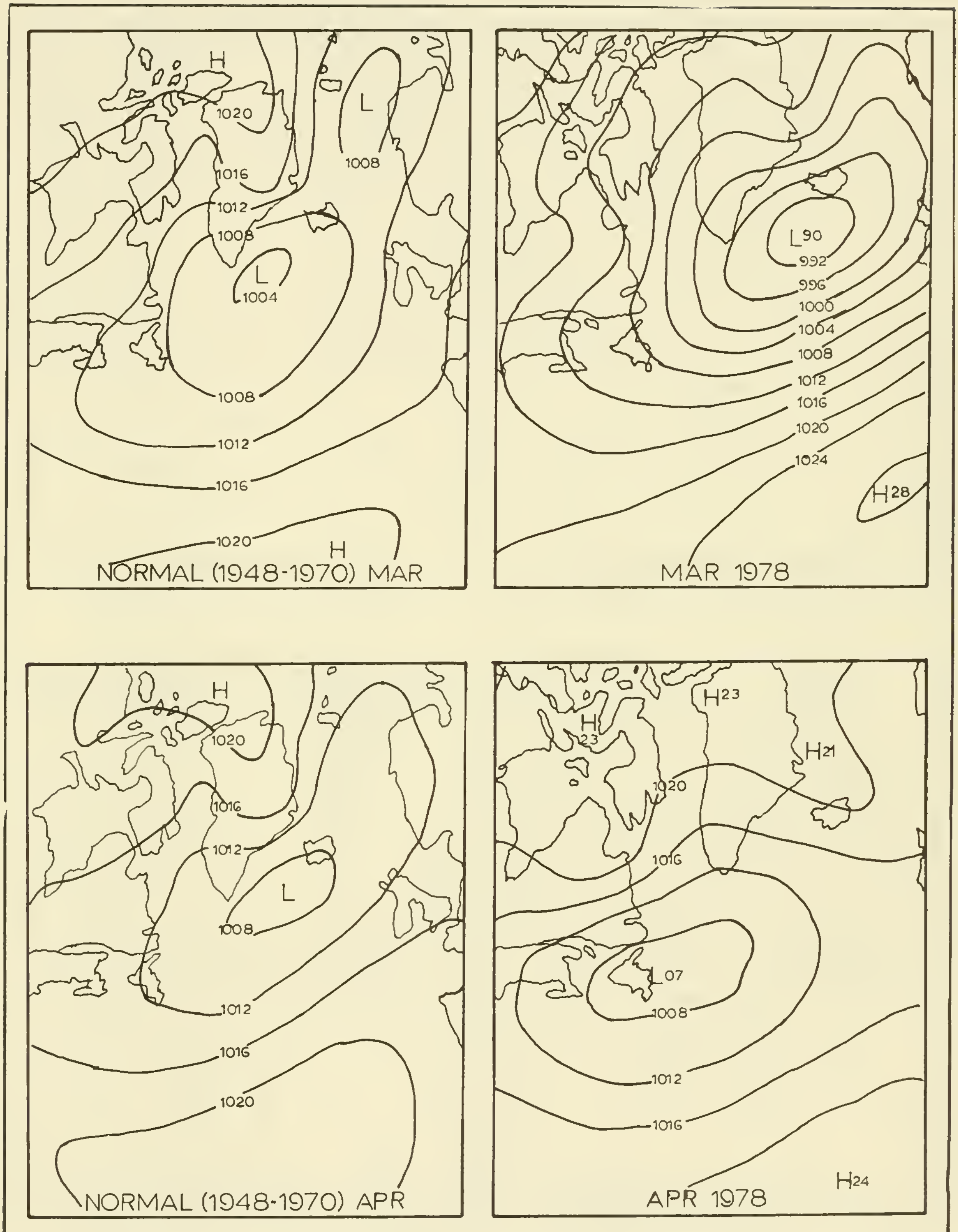
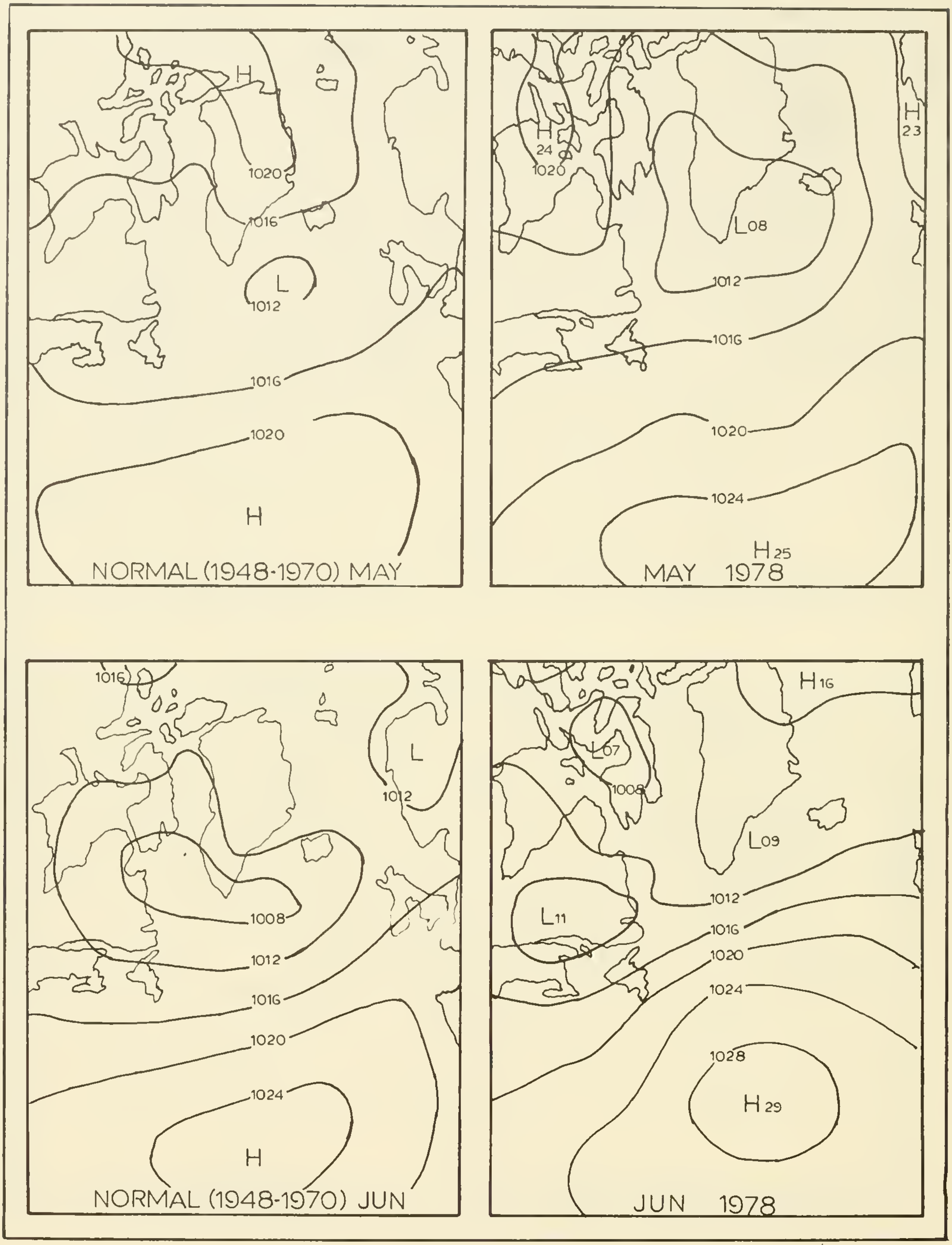
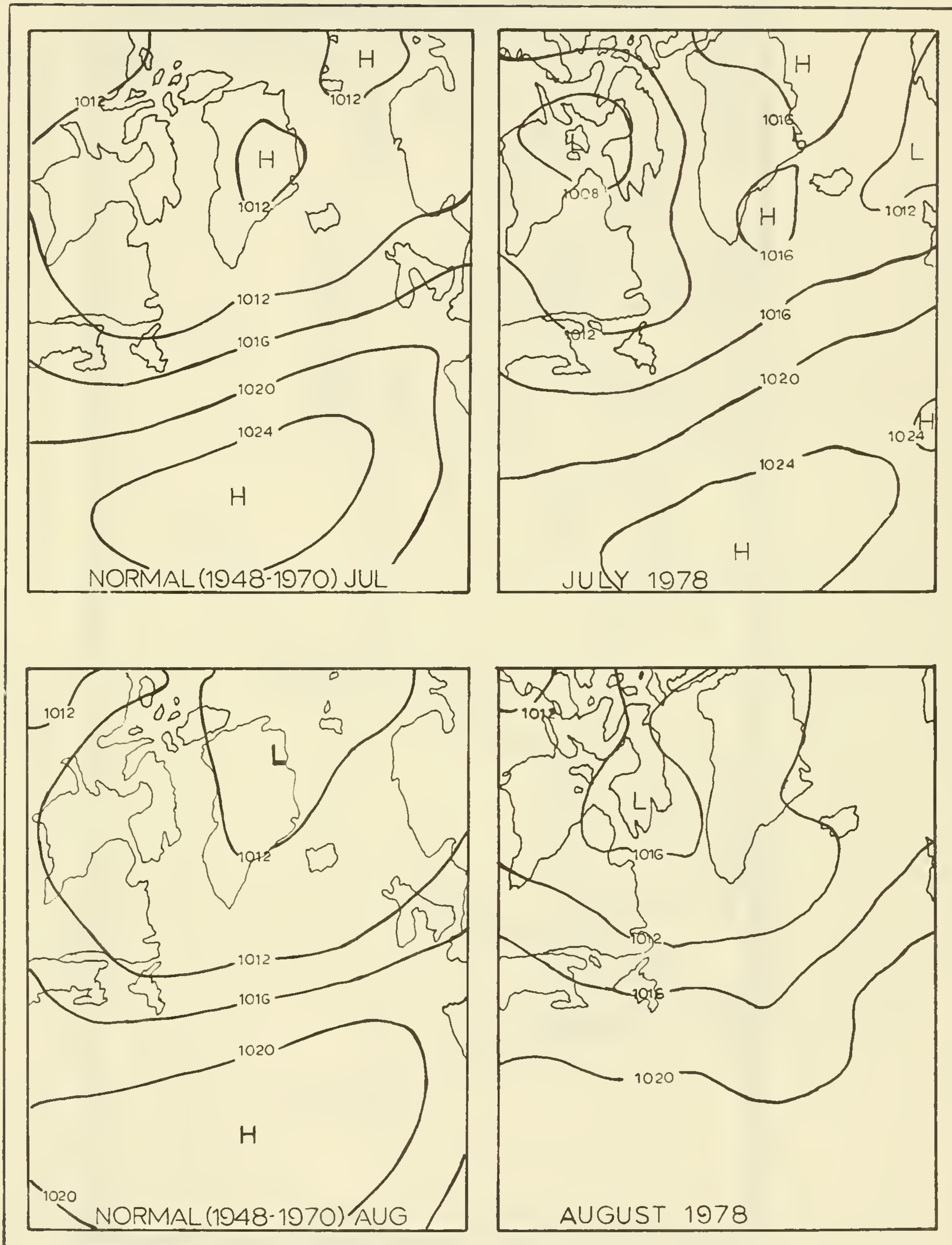


Figure 2B



H
1020
1016
L
1012
1016
1020
H
NORMAL (1948-1970) MAY
H
24
1020
H
23
L08
1012
1016
1020
1024
H25
MAY 1978
1016
L
1012
1008
1012
1016
1020
1024
H
NORMAL (1948-1970) JUN
H16
L07
1008
L09
L11
1012
1016
1020
1024
1028
H29
JUN 1978

Figure 3B



1012
H
1012
H
1012
1012
1016
1020
1024
H
NORMAL (1948-1970) JUL
H
1016
1008
L
1012
H
1016
1016
1012
1020
H
1024
1024
H
JULY 1978
1012
L
1012
1012
1016
1020
H
1020
NORMAL (1948-1970) AUG
1012
L
1016
1012
1016
1020
AUGUST 1978

Figure 4B

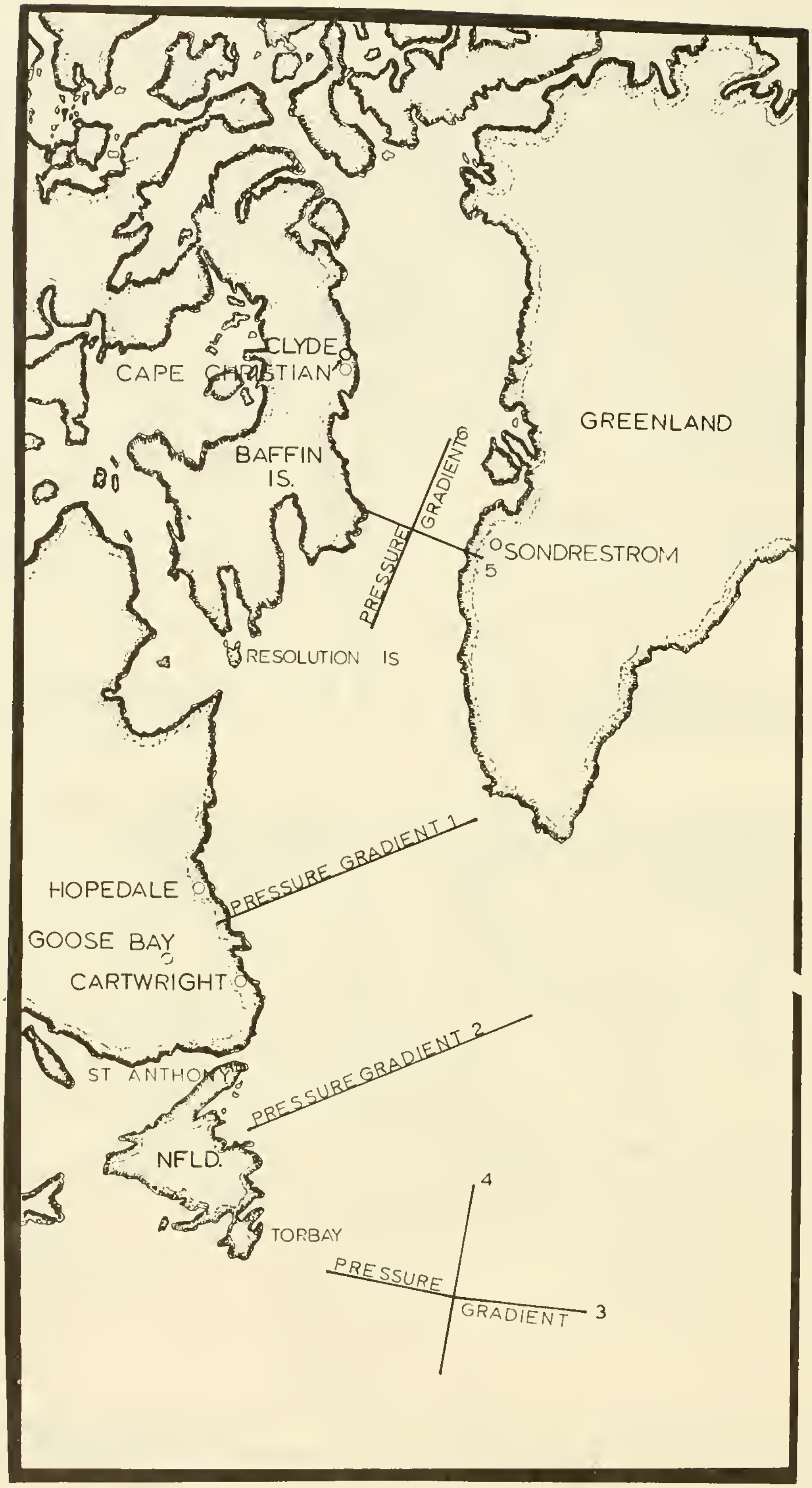

CLYDE
CAPE CHRISTIAN
BAFFIN IS.
GREENLAND
PRESSURE GRADIENT 6
SONDRESTROM
5
RESOLUTION IS
PRESSURE GRADIENT 1
HOPEDALE
GOOSE BAY
CARTWRIGHT
PRESSURE GRADIENT 2
ST ANTHONY
NFLD.
TORBAY
4
PRESSURE GRADIENT
3

Figure 5B

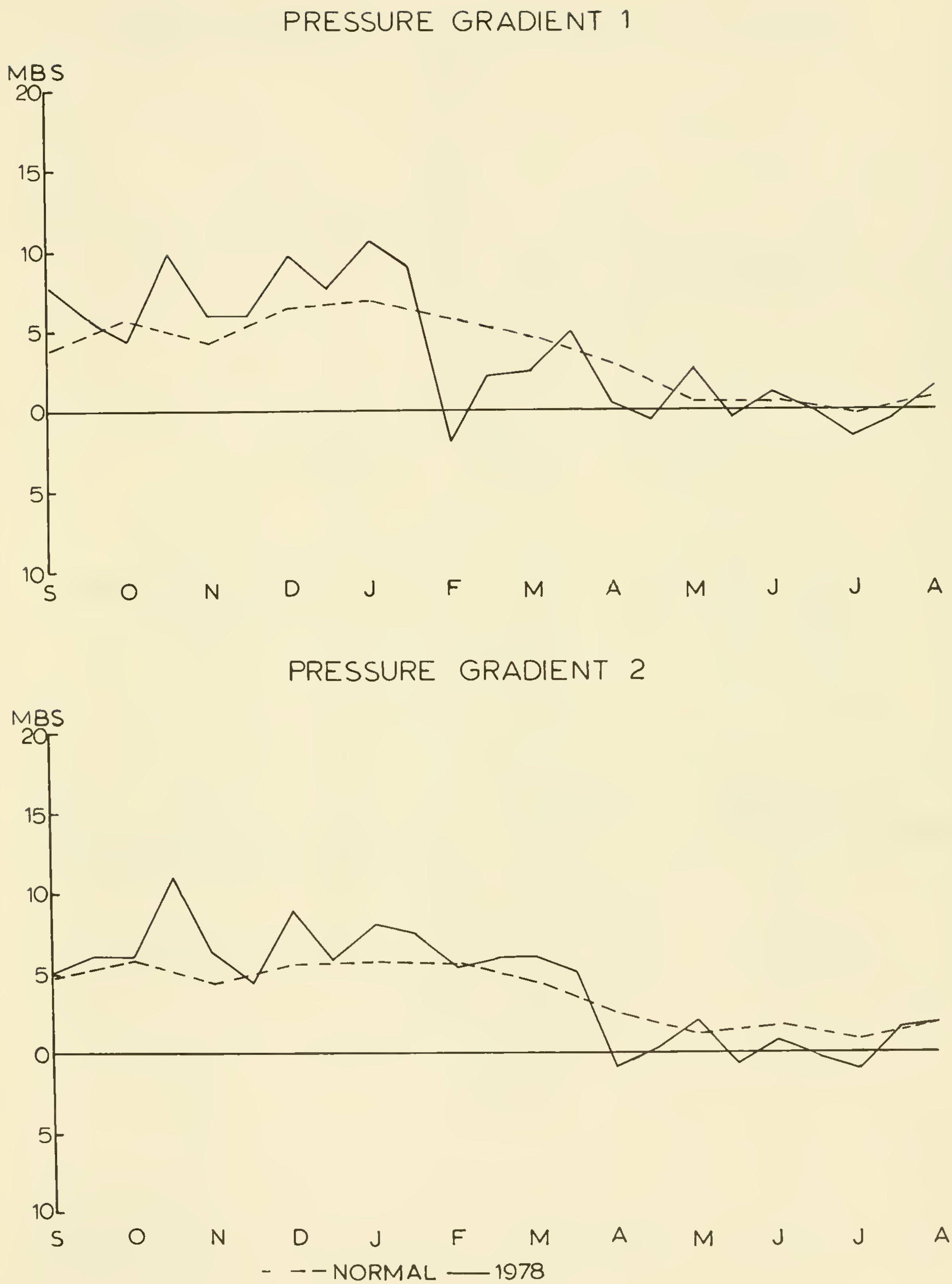

PRESSURE GRADIENT 1
MBS
20
15
10
5
0
5
10
S O N D J F M A M J J A
PRESSURE GRADIENT 2
MBS
20
15
10
5
0
5
10
S O N D J F M A M J J A
- - - NORMAL —— 1978

Figure 6B

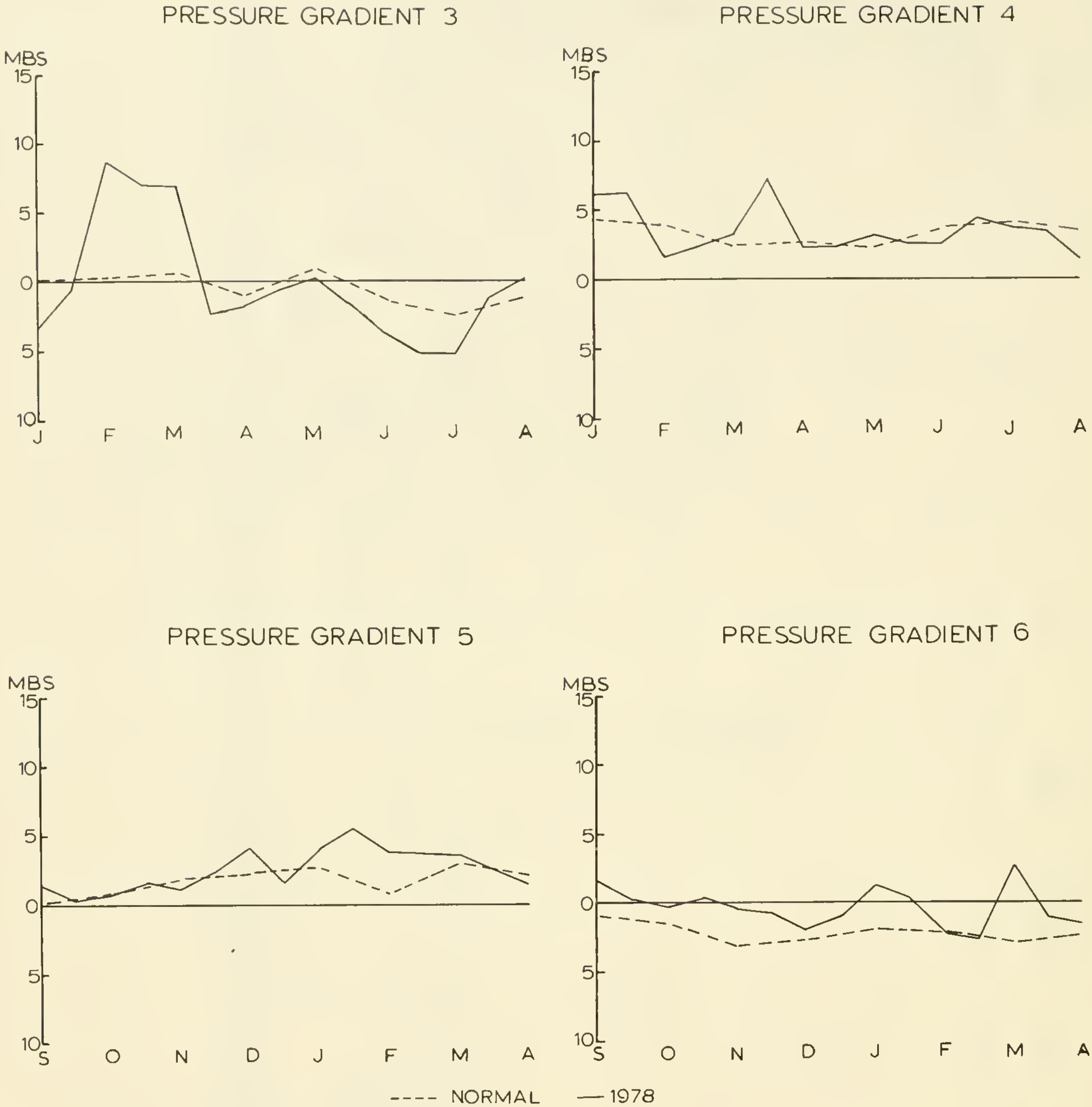

PRESSURE GRADIENT 3
PRESSURE GRADIENT 4
PRESSURE GRADIENT 5
PRESSURE GRADIENT 6
MBS
15
10
5
0
5
10
J F M A M J J A
S O N D J F M A
---- NORMAL
— 1978

Figure 7B

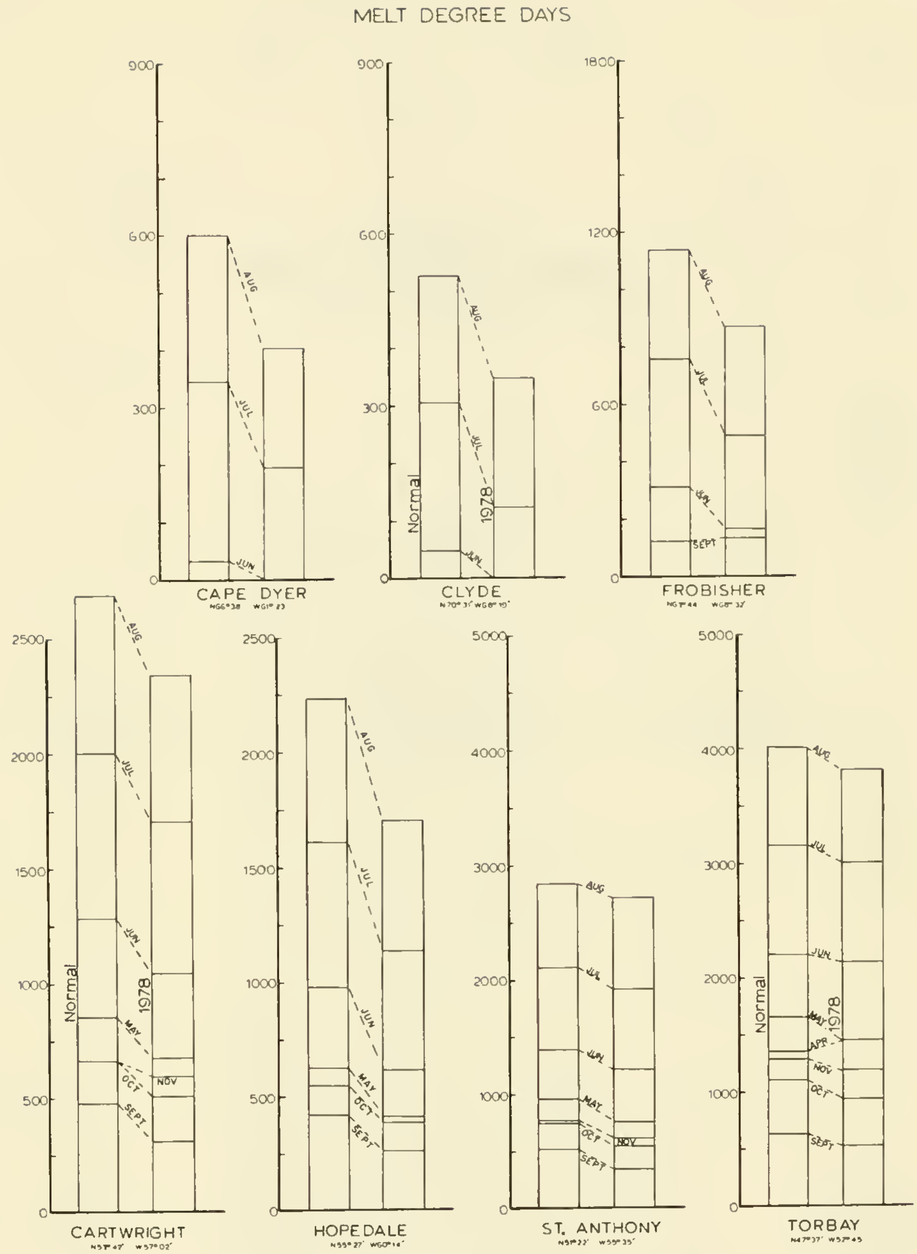
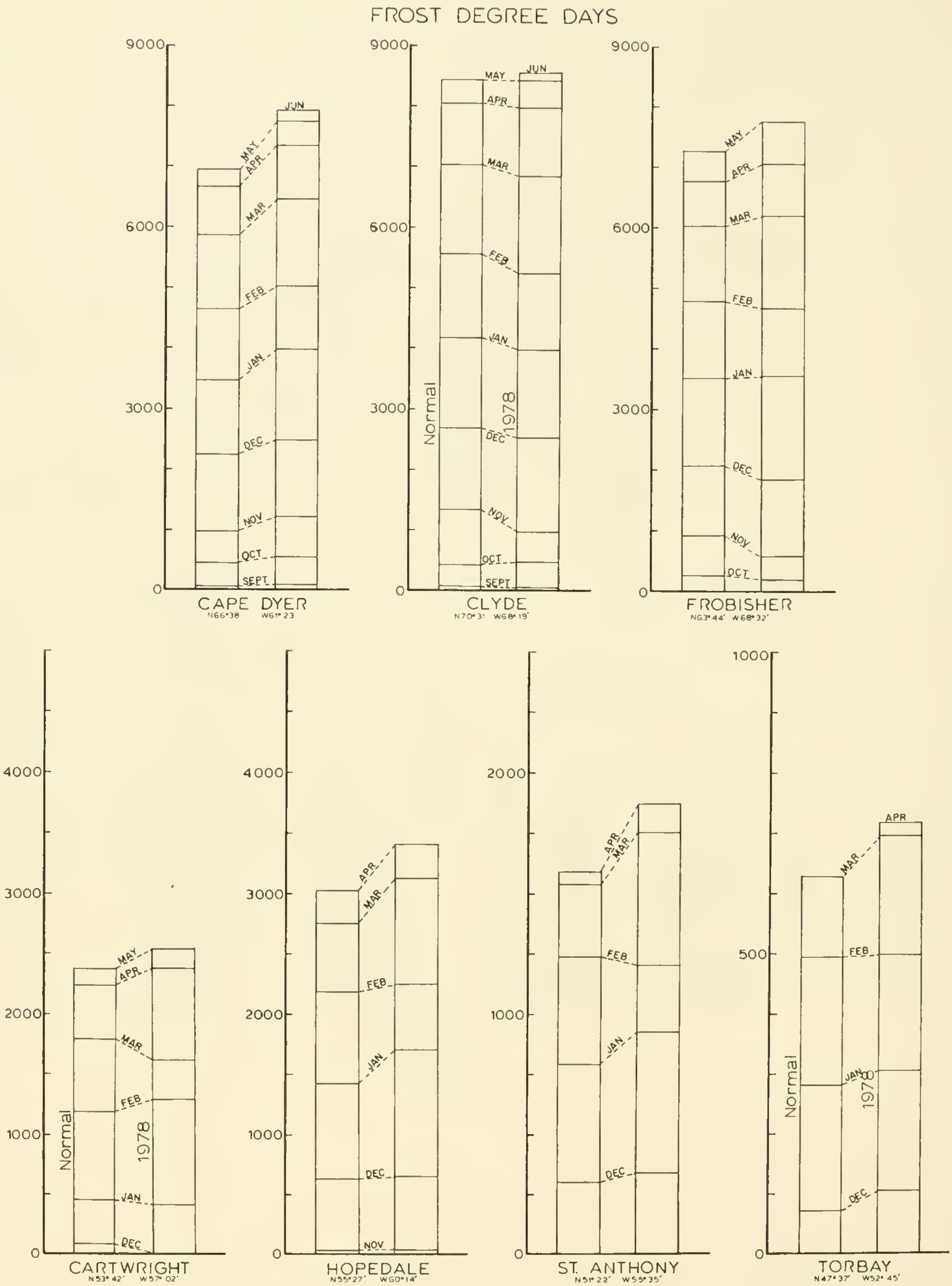

MELT DEGREE DAYS
CAPE DYER
CLYDE
FROBISHER
CARTWRIGHT
HOPEDALE
ST. ANTHONY
TORBAY
Normal
1978
AUG
JUL
JUN
MAY
APR
SEPT
OCT
NOV

Figure 8B



FROST DEGREE DAYS
9000
6000
3000
0
SEPT
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
Normal
1978
CAPE DYER
N66°38 W61°23
CLYDE
N70°31 W68°19'
FROBISHER
N63°44' W68°32'
4000
3000
2000
1000
500
CARTWRIGHT
N53°42' W57°02'
HOPEDALE
N55°27' W60°14'
ST. ANTHONY
N51°22' W55°35'
TORBAY
N47°37' W52°45'

Figure 9B

APPENDIX C
INTERNATIONAL ICE PATROL
ICE AND SST REPORTS
FOR 1978

COUNTRY OF REGISTRY	SHIPS	TOTAL ICE REPORTS	TOTAL SST REPORTS
BELGIUM	FRUBELAMERICA (ONFX)	1	
	HASSELT (ONHA)	1	
	MINERAL (ONMA)	1	
CANADA	HMCS ALGONQUIN (CZJX)	2	1
	CTU ARGUS (VP415)	1	
	HURON (NATO) (CGXY)		8
	CCGS JOHN CABOT (CGDJ)	1	
	A.T. CAMERON (CGBD)	2	1
	CCGS BARTLETT (CGDR)	1	
	CSS HUDSON (CGDG)	16	14
	ICE CENTRAL OTTAWA	9	
	ST. LAWRENCE PROSPECT (VGNW)	3	
	CCGS NARWHAL (CGBP)	1	
	PROTECTEUR (CYTV)		4
	CAPE ROGER (VCBT)	1	
CUBA	RIO SAGUA (COJH)	1	
FINLAND	CHASE I (OIHX)	1	
	FINNFOREST (OGIL)	6	6
	PASSAU (OIDI)		1
FRANCE	ATLANTIC COGNAC (FNZE)	1	
	PENMARCH (FNUU)	1	
GERMANY	ANTARES (DLXR)	1	2
	ELBE EXPRESS (DHEE)	1	
	EVELYN BOLTEN (DNFE)	2	2
	PETER KNEPPEL (DGPK)	1	
	WIDAR (DHDW)	1	1
GREECE	ATLANTIC CHAMPION (SXQH)	1	
	ATREUS 2 (SYET)		1
	ELOCEAN (SXFT)	1	4
	GRACEL (SWKZ)	1	
	MELTEMI 2 (SYCH)	1	9
	BULKCARRIER SUCCESSOR (SVYR)	1	
	YANGOS COLOCOTRO (SXDZ)		3
ICELAND	BAKKAFOSS (TFXQ)	12	96
	BRUARFOSS (TFUA)	1	
	SELFOSS (TFEB)	1	
	SKAFTAFELL (TFHB)	2	

INTERNATIONAL ICE PATROL
ICE AND SST REPORTS
FOR 1978

COUNTRY OF REGISTRY	*SHIPS*	*TOTAL ICE REPORTS*	*TOTAL SST REPORTS*
INDIA	RATNA KIRTI (ATJD)	1	4
	JAGDHARMA (ATNJ)	3	3
JAPAN	ACACIA (JPYW)	1	4
	KOSIE MARU (JLSP)		4
	NIPPON MARU (JJJS)	2	
LIBERIA	ARTADI (5MAN)	7	6
	ATLANTIC MARQUES (ELOE)	1	
	CARBREEZE (A8FV)		1
	EASTERN RIVER (D5ES)	2	1
	GEMINI FRIENDSHIP (6ZQK)		5
	KATHLEEN (ELHW)	3	6
	KUNGSHOLM (A8YR)	1	
	OCEANIC KRISTIN (A8TW)		2
NETHERLANDS	DORDRECHT (PDRW)	2	
	DUIVENDRECHT (PDTQ)	1	
	TEMPO (PHXF)	2	
	VIANA (PIGS)	1	
NETHERLANDS ANTILLES	GOGOFRIO (PJUS)	1	
	THUREDRECHT (PJRD)	2	
NIGERIA	POROS ISLAND (5B2616)	1	3
NORWAY	BRUNHORN (LMLT)	1	
	BRUNLA (JXCT)	1	
	HYSTEIN (JXMJ)	1	
	TANAFJORD (LDRT)	1	
POLAND	STEFAN BATORY (SPYM)	3	
	GARDNO (SNSO)	1	
	ZIEMIA KRAKOWSKA (SQBL)		2
	SYNPULKU (SQDK)		
	WIECZNG (SNSP)	1	
PORTUGAL	BRITES (CUFP)	1	
SPAIN	MARQUES DE BOLARQUE (EDZX)	1	
SWEDEN	IVANGORTHON (SHMN)	4	4
	MONTROYAL (SFHN)	5	1
	ATLANTIC SAGA (SLNA)	7	21
	ATLANTIS SONG (SDQT)		1
UNITED KINGDOM	AGMEMNON (GPUL)	1	
	ANADRIA (ZGAA)		5
	ATLANTIC PROSPER (GXXZ)	1	
	BRITISH AIRWAYS (FLT467)	1	
	CARCHESTER (GUDB)	2	
	CAST SEAL (GXXG)	1	
	CLYNE (ZCVY)	1	
	C.P. DISCOVERER (GNAS)	2	
	FINNISH WASA (GROQ)	4	4

INTERNATIONAL ICE PATROL
ICE AND SST REPORTS
FOR 1978

COUNTRY OF REGISTRY	SHIPS	TOTAL ICE REPORTS	TOTAL SST REPORTS
	LA CHACRA (GKDU)	1	1
	LAURENTIA FOREST (GOZS)	1	1
	LYNTON GRANGE (GVHC)	1	
	MANCHESTER CONCORDE (GYUX)	2	
	MANCHESTER CRUSADE (GORQ)	1	
	PELLERIN (GRUB)	1	1
	QUEEN ELIZABETH II (GBBT)	1	1
	SANDGATE (GVZG)		11
	SIMONBURN (GRHH)	2	
	C.P. TRADER (GNAR)	3	
UNITED STATES	USCGC EVERGREEN (NRXD)	212	212
	USNS MIRFAK (NZAE)	8	8
	USCGC NORTHWIND (NRFJ)	1	
	USNS PVT JOHN R. TOWLE (NSTY)	3	3
	SEALAND RESOURSE (WJKD)	1	
	USCGC WESTWIND (NLKL)	4	
	USNS YUKON (NVOP)	1	
USSR	NOGISNSK (UJDJ)	1	
WEST GERMANY	TILLY RUSS (DGNR)	1	
YUGOSLAVIA	BANJA LUKA (YTTC)		3
	DUBROVNIK (YTAD)	3	4